

The Towns of Dennis and Yarmouth Cape Cod Rail Trail Extension

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Feasibility Study



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Executive Summary

The Town of Dennis and Yarmouth, acting through their respective Public Works Departments, are planning the extension of the Cape Cod Rail Trail (CCRT) from its terminus at Route 134 in Dennis through both the Towns of Dennis and Yarmouth, terminating at the Yarmouth-Barnstable town line where the Town of Barnstable has plans to extend it.

Recognizing that introducing a public recreational facility like the CCRT through a primarily residential community requires acceptance from a variety of stake holders, the Town has commissioned this Feasibility Study to establish a platform from which to work with stakeholders in a collaborative manner to identify the physical, environmental, and sociological constraints and mitigation measures for acceptance of the CCRT extension.

The study examined constructing the 5.2-mile extension of the rail trail through the following locations:

- South Dennis: Along the Bay Colony Rail Right of Way from Route 134 to the Bass River Bridge in Dennis,
- South Yarmouth: Along the Bay Colony Rail Right of Way from the Bass River Bridge in Yarmouth to the Transfer Center located west of Station Avenue,
- West Yarmouth: Along the exiting multi-use path located in the Old Town House Road Park and the Bayberry Hills Golf Course
- Approaching the Yarmouth/Barnstable Line: Through the well fields and Old Higgins Crowell Right of Way.

The general approach to the study includes the following objectives:

- Identify alternative alignments and connectivity to other resources within the Towns.
- Identify constraints along each of the alternative alignments.



- Participate in public meetings with stakeholders to solicit input on alternative alignments.
- Analyze the impacts of construction of the CCRT Extension.
- Collaborate with the affected neighborhoods to identify concerns and agree on appropriate mitigation.
- Collaborate with MassHighway to determine acceptability of CCRT design initiatives and details.
- Solicit executive approval of the recommended actions from both municipalities.
- Identify next steps for project implementation including permit and approval requirements.
- Document the findings of the Feasibility Study.

The stakeholders, including MassHighway officials, town residents and civic leaders, project abutters, the Department of Conservation and Recreation, and representatives of the respective police departments agreed in principal that extending the CCRT on publicly owned and/or controlled lands through each town was an acceptable, safe, and appropriate use of public resources. These stakeholders did, however, identify the following recommendations for consideration:

1. Recognize the proposed facility as a linear park within the communities.
2. At high volume intersections where grade separation is required, construct railroad-type through-truss structures memorializing the history of the railroad through the communities.
3. In certain neighborhoods where privacy is desired, use a combination of special alignment, vegetative barriers, and selective use of fencing to minimize visual and noise impacts.
4. MassHighway representatives require consistency with standard planning and design practices as outlined in the current edition of the Massachusetts Highway Design Guidelines and the Manual on Uniform Traffic Control Devices.
5. Promote facility connectivity to other resources within the towns through the use of public awareness programs and prudent use of 'way-finding' signs.
6. Minimize impacts to the character of historically significant neighborhoods, address security and safety issues with pathway design and also identify publicly accessible restrooms along the proposed route.
7. Ensure flexibility in the design of the geometry at the westerly terminus at the Barnstable town line to allow for connections to both the Clair Saltinstal bike route on Route 132 and the Transportation Center on Main Street in Hyannis.

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Introduction

Introduction

The impressions of Cape Cod in the minds of residents and vacationers evokes images of sandy beaches, town festival days, dynamic surf along the National seashore, Cape Cod League baseball games, fresh water trout fishing, and surf-casting for 'blues and bass' along the waterfront. Recreation is a key activity throughout "the Cape" offering significant opportunities for 'Cape Goers' to participate in wind and water surfing, golf, tennis, baseball, softball or soccer league play, and various forms of outdoor exercise including walking, jogging, in-line skating, and cycling.

Beginning as early as the 1970's the Cape Townships, the Cape Cod Commission, and various state agencies recognized the significant surge in full-time residency and vacation period activity that fills the public ways with high volumes of motorists, bicyclists and pedestrians. The competition for throughput in these once quiet roads created increased accidents, substantial peak hour traffic delays, and reserved precious little space for sharing the roads with pedestrian and cycling activities.

To address this issue, over the last 15-20 years, a new philosophy in pedestrian facility planning arose that focused on two distinct opportunities as follows:

- **Bike Routes: Share the Road Philosophy** – Recognizing that the construction of separate pedestrian facilities suitable for the use by all users (including cyclists) would require acquisition of additional right-of-way (ROW), significant financial resources for design and construction, and long lead periods for public agencies to program each project, bike routes were identified along existing public roads that sustained sufficient width for both motorist and cyclists. Today, Cape Cod has an extensive network of designated primary and secondary bike routes in all 16 townships and on Martha's Vineyard and Nantucket.
- **Bike Paths: Separate Multi-use Pedestrian Facilities** – Planners of pedestrian facilities understand that cycling is used for a variety of purposes including as a sporting activity, connectivity to recreational and/or institutional destinations,

and, to a lesser degree, commuting. Bike routes are very efficient for adults' daily commuting activity; however, the off-road pedestrian facilities offers a higher level of safety for the senior citizens' activities, children cycling to school or the park and/or individuals out for a jog, walking, or rollerblading. These latter activities are difficult to perform safely along the shoulder of active, public roads. It is therefore prudent to offer alternative multi-use pedestrian facilities that are separate from public roads that provide the requisite measure of safety.

Recognizing a need for a multi-use pedestrian facilities for the Cape, the Commonwealth of Massachusetts, through it's Department of Conservation and Recreation (DCR), constructed such a facility—the Cape Cod Rail Trail (CCRT) along an abandoned rail corridor beginning in the town of Dennis (at Route 134) and extending easterly through the towns of Brewster, Orleans, and to the southern end of Wellfleet. Although there are no statistics on usage, visitors to the Cape Cod Rail Trail during the summer vacation months will encounter an impressive population of non-motorized users throughout the 22-mile facility. The official CCRT Web-site boasts...

'...Its paved surface, few hills, and well-marked automobile crossings make it ideal for cyclists. The trail has a wide unpaved shoulder on one side to accommodate horseback riding, walkers, and runners.

There are many opportunities to get off the trail and visit a beach. Food and water are also readily available and public restrooms can be found at Nickerson State Park, Salt Pond Visitors Center at Cape Cod National Seashore and the National Seashore Headquarters. If you do not have a bike, bike rentals are available at many points along the way. For people with disabilities, a limited number of hand-cycles are available for rent at specific bike concessions.'

Recognizing the successful use of the existing section of the CCRT, the Cape Cod Commission, the regional planning agency for Cape Cod, commissioned a feasibility study in 1994 to identify a possible route to extend the CCRT to the west through the Town's of Yarmouth, Barnstable, and Sandwich. The goal of this study was to identify a feasible corridor in which to plan a westerly extension of the CCRT from its terminus on Route 134 to the Cape Cod Canal in the town of Sandwich. The study alignment's preferred alternative focused on the existing railroad right-of-way owned by the Executive Office of Transportation (EOT). Given that the rail facility was active in the early 1990's, the objective was to construct a "Rails-with-Trails" facility that would allow both the active rail and the multi-use pedestrian to co-exist in the railroad right-of-way.

The report's recommendations concluded that a northern route was feasible, connecting Route 134 with the Cape Cod Community College (CCCC) via the railroad ROW; however, and due to the rather substantial impact to critical environmental resources along the railroad ROW from CCCC to the Canal, the Cape Cod Commission's Bicycle Advisory Committee agreed that the western portion of

the proposed rail trail was not feasible, ending the hope of a regional bike path connection throughout the length of Cape Cod at that time.

Purpose of Feasibility Study

Shortly after the completion of the 1994 Cape Cod Rail Trail Extension study in the mid-1990's, the Town's of Yarmouth and Dennis, acting through their respective Department's of Public Works, contacted both William Delahunt, Massachusetts 10th congressional District, and U.S Senator Edward Kennedy to solicit Federal support for the planning and design of a feasible extension to the existing CCRT westerly through both towns. There was no preference to a particular alternative route defined at that time. Representatives of each federal legislative office identified a variety of challenges in place that required resolution before Federal support could be achieved as follows:

- **Project Funding:** Federal Surface Transportation funding programs like the Intermodal Surface Transportation Efficiency Act Transportation System (ISTEA), (authorization of \$645 million for Intelligent Transportation Systems (ITS) projects for the fiscal years 1992 through 1997) and National Economic Crossroads Transportation Efficiency Act (NEXTEA) (authorization of \$1.3 billion for ITS projects for the fiscal years 1998 through 2002) included funding commitments to improve safety and air quality to enhance communities. The funding for these programs were fully committed leaving no extra dollars for the CCRT extension. To be considered for the next round of Federal Surface Transportation funding through Safe, Accountable, Flexible, and Efficient Transportation Equity Act (SAFETEA), the community was required to ensure that the path was of regional significance, better define the location of the project, and develop a conceptual construction cost estimate.
- **Rights-of-Way:** Obtain necessary rights over all land required to construct the multi-use facility.

To program the funding, the communities recognized that the CCRT extension must be regional in scope such that the proposed alignment not only provide connectivity to local cultural and institutional destinations, but also provide a link to adjacent communities; therefore, the earliest stage of project development included coordination with the Town of Barnstable to seek connection points in that town; thereby satisfying state and federal requirements for system regional connectivity. This study validates the regional objectives of the proposed multi-use pedestrian facility.

This study was also conducted to serve as a vehicle to build consensus with the various stakeholders within the towns of Yarmouth and Dennis and with specific agencies throughout the region including the Cape Cod Commission, DCR, the Massachusetts Highway Department (MassHighway), and the Town of Barnstable. A

thorough public outreach program was conducted to share ideas and solicit input from all of the groups to ensure that the proposed facilities would be designed to serve the greatest number of users. The details of this program are presented in latter sections of this report.

Project Study Corridor

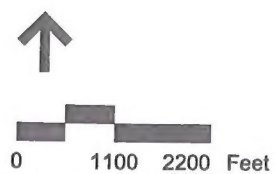
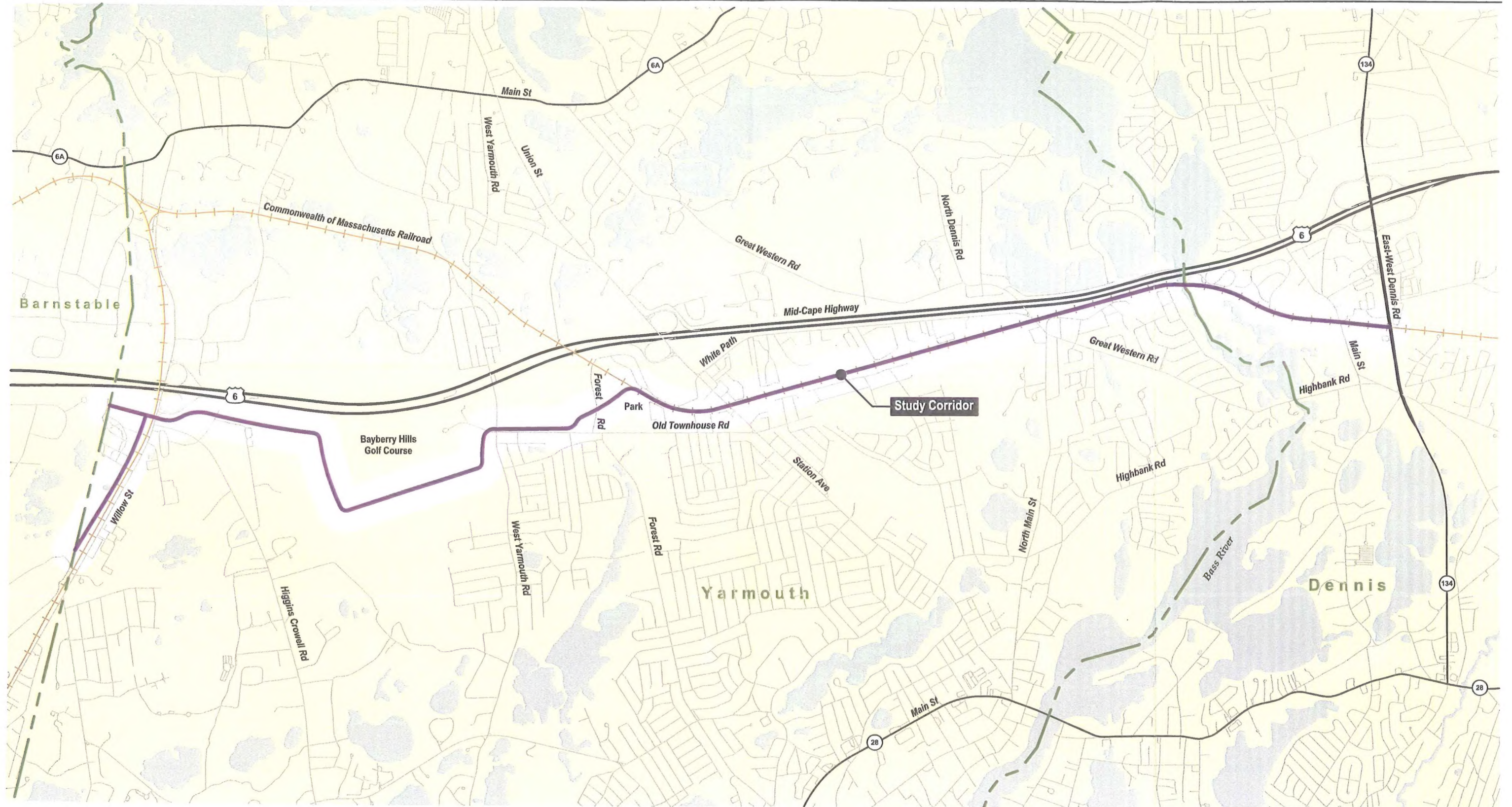
The study corridor, as shown in Figure 1, begins at Route 134 in Dennis at the terminus of the existing CCRT, currently owned and maintained by the Commonwealth of Massachusetts DCR. The study corridor extends westerly through the towns of Dennis and Yarmouth within the old railroad right of way controlled by the Department of Transportation and Construction or properties either controlled or owned by these municipalities. The following is a general description of the study corridor presented by section:

Town of Dennis

- **Route 134 to Bass River (Dennis/Yarmouth town line):** The study area is centered on the existing Commonwealth of Massachusetts EOTC rail right-of-way. Land use is residential on the south side with residential, industrial and commercial properties on the north side. A portion of this segment is located adjacent to Route 6 Mid-Cape Highway rest area. The Dennis Historic District includes properties on either side of Main Street. The Indian Lands Conservation Area and the Dennis Town Hall complex are found on the south side of the corridor, west of Main Street.

Town of Yarmouth

- **Bass River (Dennis/Yarmouth Town Line) to North Main Street:** The study area is centered on the existing Commonwealth of Massachusetts EOTC rail right-of-way. Land use is residential on the south side. The north side is bounded by the Route 6 Mid-Cape Highway.
- **North Main Street to Station Avenue:** The study area is centered on the existing Commonwealth of Massachusetts EOTC rail right-of-way. Land use is town DPW Water Division lands and residential on the south side with an industrial/commercial mix on the north side.
- **Station Avenue to Forest Road:** The study area is centered on the existing Commonwealth of Massachusetts EOTC rail right-of-way to a point just east of the solid waste transfer station and Yarmouth septage treatment plant. The land use is a mixture of both commercial and industrial throughout this section. From this point the study area departs from the EOTC rail right-of-way and follows the municipal property line, delineating the Old Town House Road Park from the Yarmouth residential transfer station. Except for the commercial properties surrounding Forest Road Extension, the use is institutional (municipal facilities).



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Figure 1

Study Corridor

Cape Cod Rail Trail Extension
Dennis & Yarmouth, Massachusetts



- **Forest Road to West Yarmouth Road:** The study area generally follows the north side of the Old Town House Road layout. The land use is institutional (municipal facilities) with Bayberry Hills Links Golf Course to north and residential on the south side of Old Town House Road.
- **West Yarmouth Road to Willow Street:** The study area generally follows the southerly perimeter of the Bayberry Hills Golf course (adjacent to the NSTAR power easement) to the westerly limit of the golf course. The study area then follows a circuitous path through the Higgins Crowell Road Town well fields, circumventing the commercial properties on Mid-Tech Drive. The study area then runs along the old Higgins Crowell Road alignment to the intersection of Willow Street.
- **Willow Street to the Barnstable Town Line:** The study area runs along the west side of the Willow Street to the south and through Yarmouth Town-owned property to the west. The land use is primarily residential.

As previously mentioned, all land within the study area is either owned or controlled by the Towns of Yarmouth or Dennis. As for the Commonwealth of Massachusetts EOTC rail right-of-way (ROW) property, the Towns of Dennis and Yarmouth will have the right to construct and maintain the bike path under a 'Memorandum of Agreement.' Bay Colony railroad has a lease agreement with EOT to operate a solid waste transfer activity along the Commonwealth of Massachusetts EOTC rail right-of-way property located west of Station Avenue. The aforementioned 'Memorandum of Agreement' will include provisions to allow the Town of Yarmouth to operate and maintain a 'rails-with-trails' facilities within the railroad ROW.

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Existing Conditions Analysis and Pathway Considerations

The proposed Cape Cod Rail Trail (CCRT) extension is approximately 5.2 miles, extending west from the terminus of the existing Department of Conservation and Recreation (DCR) CCRT at Route 134 in Dennis. It will pass through Dennis and Yarmouth, Massachusetts to the Town of Barnstable (see Figure 1, Project Location Map). The proposed pathway will extend the current 22-mile bike path and connect a variety of cultural, historical, and natural resources in both towns. Existing parks, schools, other community facilities and neighborhoods could also be connected to this linear park with separate linkages, some of which are already in place, creating a unique community and regional resource.

Existing conditions were evaluated along the anticipated route to understand opportunities and constraints that need to be addressed during design development, which for the most part is within the abandoned railroad right of way (ROW) to Station Avenue in Yarmouth. Just west of Station Avenue the CCRT will need to share a small segment of active rail line where switching activities are required for access to the Yarmouth/Barnstable Solid Waste Transfer Station. Continuing west, the alignment will follow the existing pathways through Old Townhouse Road Park and Bayberry Hills Golf Course and finally through Yarmouth DPW Water Division lands and along the old Higgins Crowell Road to Willow Street at the westerly terminus of the proposed CCRT which will extend along the western side of the railroad ROW to the town line and/or through Town-owned lands along Route 6 to the Town of Barnstable. From the western terminus points, there are two planned routes identified by the Town of Barnstable which could connect the CCRT extension to the intermodal transportation center in downtown Hyannis and/or the Hyannis Airport parking areas with bus service to downtown, or along the Route 6 ROW to Exit 6 and ultimately connecting the CCRT to the existing the Claire Saltonstall Bikeway and the Cape Cod Canal.

Figures 2 through 6 found at the end of this section depict the existing conditions described below.

Town of Dennis

Approximately 0.9 miles of the proposed trail is within the town of Dennis (See Figures 2 and 3). In Dennis, the planned extension will be entirely within the abandoned rail corridor, beginning at the current CCRT terminus at Route 134 and extending west to the Bass River Bridge. Along the majority of the route an overhead power line easement parallels the rail corridor to the south. The CCRT extension is located within the Dennis Historic District, adjacent to the Dennis Town Hall, the Indian Lands conservation area, and the Bass River at the old railroad bridge into Yarmouth.

Along the proposed extension there are a number of design considerations including: the Route 134 crossing, impact to the recent improvements to the DCR parking area east of Route 134, the South Dennis Historical District, the Main Street crossing, abutting residential neighborhoods, the decommissioned Route 6 rest stop (which currently provides limited parking for access to Bass River) and associated wetland resource areas. The design must also address: identification of potential pathway access points to adjacent points of interest and parking, maintaining existing vegetative buffers, utility conflicts (especially overhead wires), drainage and access to restaurants and publicly accessible restrooms.

CCRT Terminus at Route 134 and Route 134 Crossing

Route 134 is a four-lane road with a two way center left turn lane oriented in a north/south direction that allows access to Route 6 and various commercial and retail businesses in Dennis. Traffic volumes for Route 134 are presented in Design Considerations below. The existing CCRT extends west from South Wellfleet and terminates in Dennis on the east side of Route 134. The DCR recently improved the CCRT and parking lot at Route 134. The CCRT takes up the majority of the available ROW at its terminus. A bike shop located to the south of the rail trail, on the other side of the power easement to the south, has an access easement across the utility ROW to the CCRT. On the west side of Route 134 there are commercial/industrial land uses including large storage tanks that are partially visible through trees and a chain-link fence which obstructs their full view. Along Route 134 in this area there are numerous restaurants with publicly accessible restrooms that could be utilized by CCRT users.

Main Street Historical District and Dennis Town Hall

The abandoned rail corridor is located within the South Dennis Historic District which extends westerly from Route 134 to the Bass River for the majority of the 5,000 feet of the corridor through Dennis. There is an existing parking lot for the Dennis Town Hall abutting the abandoned rail corridor. From this parking lot there is an existing pedestrian entrance to the ROW and pedestrian trail into the Indian Lands conservation area. The Town Hall also has publicly accessible restrooms.

Between the Town Hall and the Indian Lands are overhead wires within the utility corridor along with secondary pathways to the Indian Lands.

Indian Lands Conservation Area



The Indian Lands Conservation Area abuts the utility line corridor south of the abandoned rail corridor. This historical property includes a few pathway crossings through the rail corridor connecting the Indian Lands with the abutting neighborhood. These pathways provide a connection to a system of trails throughout the conservation area. From the abandoned rail corridor the view of the Indian Lands is filtered by the overhead utility lines in the

utility corridor, trees and undergrowth. On both sides of the rail corridor there are slopes with signs of erosion. At the end of South Riverdale, near the abandoned corridor, there is significant erosion which appears to be the result of pedestrian access and runoff from the roadway onto the railroad right of way.

Access to Route 6 Rest Stop and Bass River

Currently the abandoned rest stop area on Route 6 has limited access to the rail corridor but is used as an “unofficial” parking area along Route 6 for recreational activities at the Bass River Bridge. The rest stop was discontinued for public use because the acceleration and deceleration lanes to the rest stop are inadequate and there were security problems at the rest stop prior to its closing. Although the former rest stop has a large paved area for parking, the majority of the rest stop is fenced, restricting access to the railroad ROW. Erosion on the slope from the former rest stop is present on the informal pedestrian path to the ROW.

The old rail road bridge across the Bass River has granite abutments, large steel “I” beams and wooden trestle. Significant erosion has occurred behind the granite block abutments and needs to be repaired. From this bridge there are views of the river and marsh to the southeast. The views to the north are of the Route 6 highway and Follins Pond.



Town of Yarmouth

The CCRT Extension will enter Yarmouth at the Bass River, the municipal boundary with Dennis (See Figures 3 through 6). At the river crossing the existing rail corridor is located between residential land use to the south and Route 6 to the north. Approximately 3,700 feet west of the Bass River, the rail corridor intersects with Main Street. At the Main Street crossing, the trail corridor diverges away from Route 6 heading west-southwest. West of Main Street an industrial area borders the rail corridor to the north, and Yarmouth DPW Water Division land, the Flax Pond Recreation Area and residential areas are located to the south for approximately 1.55 miles (8,200 feet). There are right-of-way encroachments on the north side of the rail corridor by industrial uses. These industrial uses create problems with noise and dust as well as adverse visual impacts along the railroad ROW. Approaching Station Avenue the railroad ROW widens, providing a large flat open area with the potential for a rest stop and large parking area.

At the intersection with Station Avenue, the rail corridor passes through a commercial and industrial area. At Station Avenue there is a large commercial area with several restaurants and publicly accessible restrooms. Approximately 500 linear feet west of Station Avenue, the rail corridor supports an active railroad used to switch trains to and from the Yarmouth/Barnstable Solid Waste Transfer Station. The CCRT Extension will need to share the ROW with the active railroad for approximately 1,400 linear feet. The CCRT will need to be located along the southern edge of the ROW. In this segment of rail trail, between Station Avenue and Old Town House Road Park, the alignment passes by a commercial /industrial area along the southern side of the corridor and the Town of Yarmouth property associated with the transfer station and septage treatment facility to the north.

To the south, beyond the commercial/industrial area, is Old Town House Road Park. Within the park is a segment of the CCRT Extension, starting at the divergence from the rail corridor. The park segment includes a public restroom, concession building and picnic areas constructed by Yarmouth in 1999, concurrent with the closing of the town landfill and conversion to open space. West of the park boundary, the town residential drop-off area is located to the north and commercial areas are found along the corridor to the south. A crossing of the Yarmouth solid waste facilities including residential drop-off area access road is well signed but may require additional improvements to accommodate increased bicycle traffic. Past the commercial area, the existing bike path parallels Old Town House Road south of the Bayberry Hills Links golf course section located on the former landfill. The path crosses West Yarmouth Road at the entrance to Bayberry Hills Golf Course which is an intersection with a four-way stop. It then parallels the golf course entrance and then turns south, crossing the golf course driveway. There is a gravel parking area at this location serving the current bike path. The path follows the existing paved path along the golf course driving range where Bayberry Hills has requested the pathway be shifted south, if possible, to allow for driving range expansion and then follows

the southern edge of the Bayberry Hills Golf Course. Along the pathway through the golf course are several golf cart path crossings which will need to be addressed. After the golf course the existing paved pathway extends to Higgins Crowell Road with the power line on the south and Mid-Tech Drive to the north.

Two alternative alignments for the CCRT Extension were identified west of the golf course. The preferred route turns to the northward into a wooded area owned by the Town of Yarmouth Water Department. The CCRT is proposed to follow an existing footpath for part of the way through the woods. The alignment would follow a route between a warehousing/industrial area (Midtech Drive) and Route 6 before intersecting with the restricted portion of Higgins Crowell Road north of the existing paved pathway. The rail trail would then follow along approximately 1,300 linear feet of the old Higgins Crowell Road alignment through DPW Water Division land. The proposed CCRT alignment in this area bisects two Town drinking water well fields. Vehicular access on old Higgins Crowell Road is necessary to maintain these wells, and the trail may need to be shared between recreational users and Town maintenance vehicles. The alignment continues westerly to the Yarmouth/Barnstable corporate boundary west of Willow Street, a busy four-lane road, plus railroad tracks along the western side of Willow Street. From here the pathway will likely connect to the two CCRT extension routes planned by the Town of Barnstable. The northern route may extend west along the Route 6 ROW and along the edge of Division of Fish and Wildlife lands, while the southern route in the railroad ROW would have the share the ROW with the active rail line for the Cape Cod Dinner Train and would include a connection to the airport parking area and/or intermodal transportation center in Hyannis, depending on final destination selected by Barnstable. This route would need to address any impacts to the Yarmouth Camp Ground which is on the National Register of Historic Places, an on-grade crossing of the campground driveway and also a wetland adjacent to the ROW just south of the driveway.

An alternative alignment between Bay Berry Hills Golf Course and Willow Street was evaluated and dropped from further consideration. This alternative alignment followed the existing paved pathway for 2,150 feet to Higgins Crowell Road, and then was located in a cross-country alignment either through dense woods and several wetlands or along the utility easement/power line ROW. This route was dropped from further consideration due to: 1) the need to acquire land or an easement for use of the utility ROW, 2) height restrictions

ort in connection with the need for a bridge crossing at Willow Street, and 3) shallow groundwater at Willow Street which prevents using a tunnel crossing under Willow Street in this area.

Bass River and Surrounding Neighborhoods

Along the Bass River there is public swimming and fishing access. As previously discussed the bridge across the Bass River will require maintenance ensure long-term stability of the bridge structure. Significant signs of erosion are present along the Coastal Bank and Coastal Beach at the bridge.

Some dwellings in the abutting neighborhood, including Blue Rock Road, are located close to the railroad ROW. This close proximity to the ROW and proposed CCRT extension may be a concern for these homeowners.

Between the Bass River crossing and Great Western Road there are a variety of residential neighborhoods to the south that abut the railroad ROW. Along the route the private residences are partially screened with trees and fencing. Some of these fenced areas encroach upon the ROW. To the north of the ROW are views of Route 6; however, having Route 6 so close to the rail corridor also creates a significant amount of noise. Starting approximately 1,300 feet west of the Bass River there are a series of five isolated wetlands adjacent to the ROW for approximately 1,500 feet. These wetland areas are considered sensitive habitats for plant and animal life.

North Main Street Crossing

North Main Street can have heavy vehicular traffic. The railroad ROW crossing is partially obscured where North Main Street merges with White's Path and intersection improvements are anticipated to improve safety of the bike path crossing at this location.

Commercial Encroachments, Neighborhoods and Station Avenue Crossing

Between the North Main Street Crossing and the Station Avenue Crossing there are a number of industrial uses to the north of the corridor. To the south are residential neighborhoods and the Flax Pond Recreation Area which includes the Town of Yarmouth day camp and recreation area.

The industrial buildings located between the North Main Street crossing and Dupont Avenue, to the north of the route, creates noisy and dusty conditions. Some of these businesses also encroach on the ROW. Most of the industrial area is highly visible from the abandoned railroad grade. The Flax Pond Recreation Area and DPW Water Division lands are





located south the ROW and there is a potential for pathway connection to Flax Pond Recreation Area and publicly accessible restrooms. Currently there are informal trails extending to the recreation area from the railroad corridor. From the abandoned rail corridor there are excellent views of the woodland to the south.

Where Town-owned lands exist along the Railroad ROW there is an opportunity to move the pathway alignment to the south through DPW Water Division lands to reduce impacts of the commercial/industrial encroachment. There will be topography, a large wetland and well field restrictions to take into account if the alignment moves to the south in this area.

To the west of Dupont Avenue are a self storage business and a warehouse. Abutting the corridor near the self storage business is a dense vegetative screen as well as stockade fencing. Abutting the corridor near the warehouse is a berm along the ROW perimeter. These screening features provide a barrier between the two uses, creating a better environment for the mixed use.

Approximately 1000 feet west from the warehouse on the north side of the rail corridor is a Liquefied Natural Gas tank. This tank is obscured from view by a dense wooded area. While to the south of the corridor is the Beacon Street residential area where much of the railroad grade is raised above the adjacent properties. There is limited screening between the railroad corridor and these residential properties to the south. The proposed alignment, where possible, will be moved to the north where the CCRT extension abuts Beacon Street residences to lessen potential impacts. There is an existing 8-foot stockade fence to help screen some of these backyard yards, but additional fencing and screening have been requested by the neighborhood group. A site meeting is proposed with this neighborhood during the preliminary design phase once the exact alignment can be determined and staked to discuss the potential and desired mitigation options along the residences.

Station Avenue is a three lanes wide and, due to the high volume of traffic on Station Avenue, poses a potential safety issue. Along Station Avenue, south of the rail corridor, is a commercial area with publicly accessible restrooms.

Active Railroad and Fruean Avenue

Approximately 1500 feet west of Station Avenue the proposed alignment will be located within the active Cape Cod railroad right of way. The CCRT will need to be located on the southern side of the ROW to avoid conflicts between active railroad use and the CCRT. To the south of the alignment is Fruean Avenue, where at least one property encroaches onto the railroad right of way.

Old Townhouse Road Park and Bayberry Hills Golf Course



Old Townhouse Road Park is a public park with various amenities including restrooms, a concession area, and a picnic area. These amenities will be available to CCRT users. The park has baseball and soccer fields as well as a basketball court. There is an existing bike path through the park. The proposed CCRT extension would connect to this existing bike path, with minor improvements including new pavement, anticipated to maintain needed

clearances along bike path as well as minimize park impacts and conflicts. To the north of the park are the Town of Yarmouth solid waste/recycling residential drop-off area facilities that are screened from view from the park. To the south of the park is Old Townhouse Road with the senior center with additional overflow parking for the park, connected by a pathway and pedestrian crossing of Old Town House Road and various commercial buildings near the intersection of Forest Road.



To the west of the park is the Bayberry Hills Links Golf Course. From the existing paved path there are excellent tree-filtered views of the golf course. Along this section of the path the 10-foot pathway will require repavement and selective clearing to maintain clearances due to minor root penetration and tree encroachment. Three hundred feet to the east of West Yarmouth Road is an isolated protected wetland.

At West Yarmouth Road the intersection is controlled with a four-way stop and the existing paved path has a designated crossing with bicycle gates. There is evidence of some poor drainage to the west of West Yarmouth Road along the golf course access drive. The golf course clubhouse is located west of West Yarmouth Road, and at this location there is a public restroom and concession area. Also located at the clubhouse area is an existing gravel parking lot that abuts the existing paved path, while a paved parking area is found closer to the clubhouse. The gravel parking area is available to CCRT users. The existing 8-foot-wide paved path is located along the south side of the golf driving range. This segment provides filtered views on both sides of the trail. The existing paved path extends through the southern portion of the golf course property. The path must be widened to 10 feet and the shoulders must be cleared to an offset of 2 feet to 3 feet to satisfy minimum design standards. On both sides of the trail there are excellent views of the golf course. Several golf cart

paths cross the paved path. There is a utility corridor with overhead power lines to the south of the Old Townhouse Road right of way.

North Route for CCRT Expansion, Higgins Crowell Road, South Route for CCRT



Between the Bayberry Hills Golf Course and Mid-Tech Drive is large woodland. A relatively level unpaved pedestrian/equestrian trail extends through these woods and provides ideal topography for a bicycle path. The preferred alignment would turn to the north, west of the golf course, and pass to the north of Mid-Tech Drive and parallel Route 6. The section of trail in close proximity to Route 6 has tree-

filtered views of Route 6; however, one experiences a moderate amount of road noise from Route 6 in this segment. There is no established trail to the west of Mid-Tech Drive. There are three town well fields located in this area. These well fields require vehicular access for material deliveries and maintenance/operations. Maintenance vehicles use a portion of the abandoned section of Higgins Crowell Road. The abandoned road provides an opportunity for a parking area and rest stop for the CCRT with access to the round about at Higgins Crowell Road. The proposed northern route for the CCRT expansion would also use the abandoned section of Higgins Crowell Road to establish the trail and connect to Willow Street.

The proposed Northern Route would not require a crossing on the active portion of Higgins Crowell Road, but would follow the abandoned portion of Higgins Crowell Road to Willow Street. Should the southern route for the CCRT expansion be selected it would cross the active portion of Higgins Crowell Road. The point where the trail would need to cross the road does have good sight distance.

The alternative southern route would follow the Old Townhouse Road easement to a point approximately 700 feet to the west of Higgins Crowell Road. From that point it extends northward, towards a town well field, and then continues southwest, crossing the Old Townhouse Road easement and connecting to the existing unpaved path that exists north of Jefferson Avenue. There are many residences that abut the alternative southern route where it parallels Jefferson Avenue. Should the southern route option be selected the residences would be visible to open to the trail. There is no current vegetative screen along the alternative alignment and residential backyards and residential encroachment into the right of way is visible.

Willow Street

Willow Street was recently widened to four lanes. The proposed northern route would require a crossing at Willow Street approximately 700 feet south of Route 6. The large volume of vehicular traffic on Willow Street makes the crossing a hazard for CCRT users. The existing topography would allow for the trail to be elevated on both sides of Willow Street. This elevation difference creates an excellent opportunity for a potential bridge crossing over Willow Street. There are some areas of erosion and wetlands along Willow Street.

The Yarmouth Camp Ground is located approximately 1700 feet south of Route 6 in the vicinity of the southerly alternative alignment. This campground is privately owned. Approximately 2300 feet south from Route 6 is a wetland. This wetland directly abuts the proposed southerly route along Willow Street.



The Southern Route would cross Willow Street where Jefferson Avenue and Willow Street intersect. Once across Willow Street the proposed CCRT could continue north along Willow Street.

Town of Barnstable

There are two possible routes for the CCRT in the Town of Barnstable. The northern route would follow along the Route 6 ROW while the southern route could connect to the Intermodal Transportation Center in Barnstable.



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Figure 4
Existing Conditions 3

Cape Cod Rail Trail Extension
Dennis & Yarmouth, Massachusetts

4

Multi-use Pedestrian Path Design Criteria

Design Criteria

As stated in the introduction, the evolution of multi-use pedestrian paths has spanned the last few decades. The design of these facilities evolved over time. Originally, facilities planners thought of these paths as glorified sidewalks, without regard to speeds, sight distance, pavement width or other criteria typically used for roadway design to ensure safe travel. Today, state and federal agencies take the design of multi-use pedestrian paths more seriously. The state of the art of facilities design includes a comprehensive outline of criteria intended to offer the user safe and efficient travel at appropriate speeds. The following is an outline of the major design criteria recommended for use by the American Association of State Highway and Transportation Officials (AASHTO):

- **Design Speed:** A minimum design speed of 20 miles per hour (mph) is recommended for gradients less than 4%. In locations where the downgrade is designed at 4% or greater or where powerful tail winds prevail, a minimum design speed of 30 mph is recommended. These design speeds are used to establishing radii for horizontal alignment design.
- **Travel Lane Widths:** A two-directional multi-use pedestrian path requires a minimum paved width of 10 feet; i.e. one 5-foot lane in each direction. At locations where steep grades will increase vehicle speeds or where uniform high volumes are expected, pavement widths of 12 to 14 feet should be considered.
- **Shoulder Widths and Clearances:** A 2-foot-wide (minimum) or a 3-foot-wide (preferred) shoulder is required on each side of the paved travelway. A 3-foot offset is required from the edge of the travel way to vertical obstructions such as roadside vegetation, regulatory and warning signs, or mile markers.
- **Vertical Clearance:** The AASHTO guidelines recommend that an overhead clearance of 8 feet be provided over both the paved area and shoulder area. The DCR recommends, however, that the vertical clearance should be 14 feet or

greater to facilitate the operation of heavy equipment such as maintenance trucks during both the construction phase and maintenance of the multi-use path.

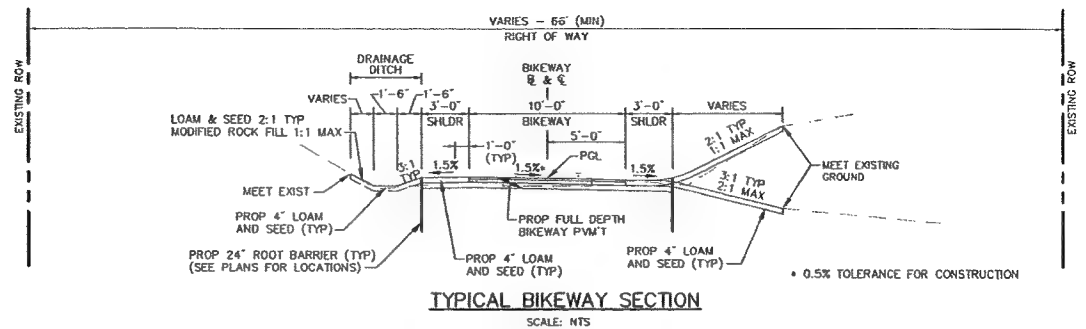
- **Horizontal Radius:** The AASHTO guidelines recommend that horizontal geometric design use the following centerline radii:
 - 36-foot radius at 12 mph
 - 100-foot radius at 20 mph
 - 156-foot radius at 25 mph
 - 225-foot radius at 30 mph
- **Grades:** Gradients are selected based on the length of the incline. The AASHTO guidelines recommend the following:
 - 5-6% grade (i.e., 5 to 6 feet vertical for every 100 feet horizontal) for up to an 800-foot incline
 - 7% grade for up to a 400-foot incline
 - 8% grade for up to a 300-foot incline
 - 9% grade for up to a 200-foot incline
 - 10% grade for up to a 100-foot incline
 - 11+% grade for up to a 50-foot incline
- **Sight Distance:** The AASHTO guidelines recommend the following minimum stopping sight distance (SSD) vs. grades for various design speeds:
 - SSD of 20 feet @ 6 mph for both ascending and descending grades
 - SSD of 60 feet @ 12 mph for ascending grades
 - SSD of 80 feet @ 12mph for descending grades
 - SSD of 120 feet @ 20 mph for ascending grades
 - SSD of 160 feet @ 20 mph for descending grades
 - SSD of 150 feet @ 25 mph for ascending grades
 - SSD of 270 feet @ 25 mph for descending grades
 - SSD of 190 feet @ 30 mph for ascending grades
 - SSD of 440 feet @ 30 mph for descending grades
- **Drainage:** The minimum pavement cross slope is ¼ inch per foot. The maximum shoulder cross-slope is 2 inches per foot. Country-style drainage is recommended, whereby rainfall and snowmelt drains laterally to adjacent ground, avoiding the need for collection systems and point distribution. Where the path is located in a cut section (i.e., below the adjacent landform), drainage swales (v-ditches) should be constructed outside of the shoulder area.

Typical Section

A variety of field conditions require a variety of cross-sectional configurations to minimize impacts to the environment and provide safe and convenient passage by cyclists. The following review of typical sections are developed using the design criteria outlined above:

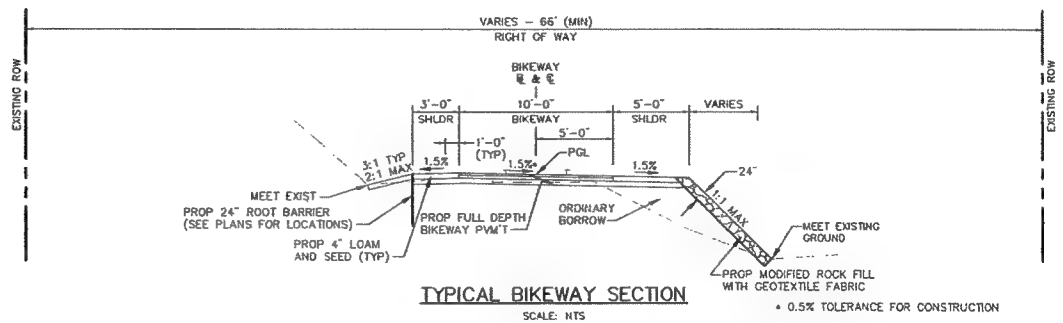
Section 1

Section 1 demonstrates the various cross-sectional elements necessary in both cut-and-fill locations.



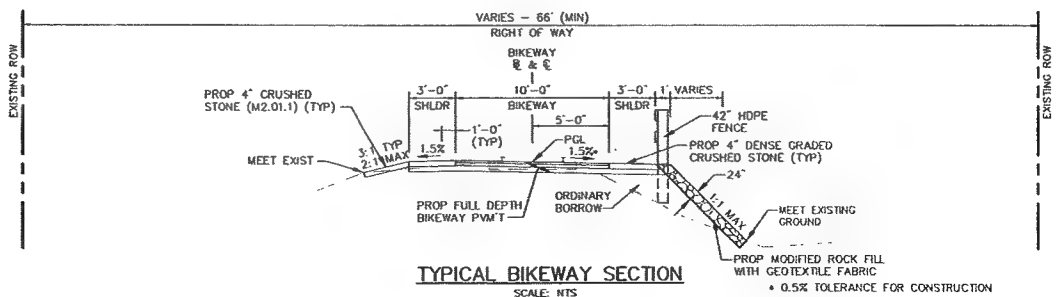
Section 2

Section 2 employs the use of riprap to create a stable slope in locations where the designer desires to minimize impacts to wetlands or adjacent private property at locations where there is room for a 5-foot shoulder.



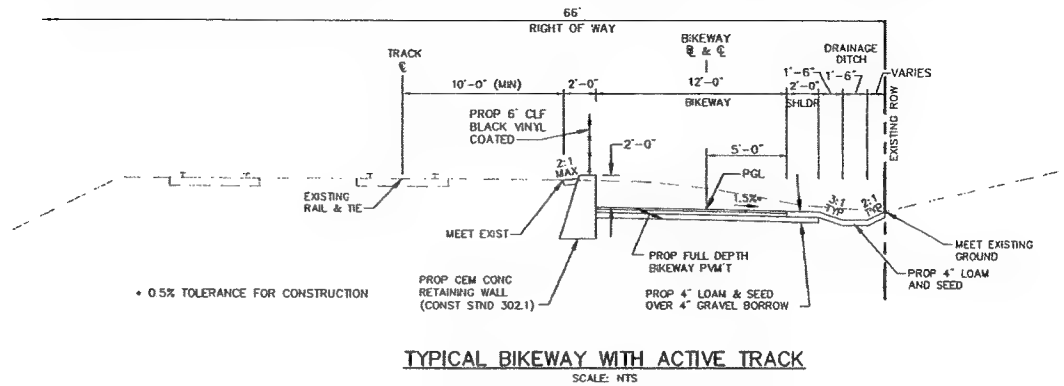
Section 3

Section 3 employs the use of safety fencing and riprap to create a stable slope in locations where the designer desires to minimize impacts to wetlands or adjacent private property at locations where the minimum 3 foot shoulder is used.



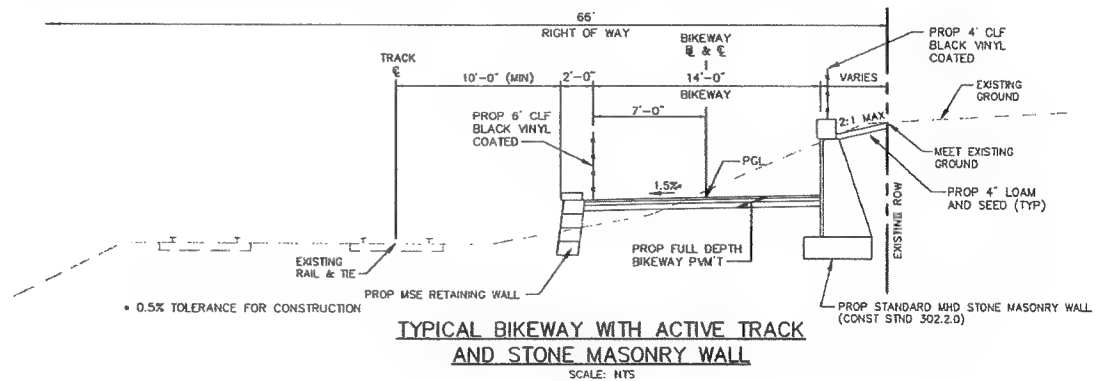
Section 4

Section 4 employs the use of safety fencing and a retaining wall in locations where the designer desires to minimize impacts at an active rail bed in a cut section.



Section 5

Section 5 employs the use of a variety of retaining walls in locations where the designer desires to minimize impacts at an active rail bed in a fill section.



5

Design Considerations

Introduction

There are a variety of locations where the multi-use facility study area intersects public streets and, therefore, pedestrians must contend with the motor vehicles to safely negotiate crossing from one side of the road to the other. In instances where the average daily volume of vehicles exceed 15,000 to 20,000 vehicles per day (vpd), the DCR and MassHighway have established a standard of separating the pedestrians from the motorist using either bridges or tunnels. Examples of grade separation can be found at various points along the existing portion of the CCRT from Dennis to South Wellfleet and include the following:

- Tunnels:
 - Villages Drive Underpass north of Ocean Edge Golf Course
 - Route 6A Underpass at Nickerson State Park
 - Route 6A Underpass north of Flax Pond
- Overpasses:
 - Steel Girder Bridge over Route 6 at West Road
 - Steel Girder Bridge over Route 6 at Rock Harbor Road

Traffic volumes collected by the Cape Cod Commission for the project intersections are as follows:

Street	AADT	Year
Willow Street (Yarmouth)*	23,366	(2002)
Higgins Crowell Road (Yarmouth)	5,400	(2004)
West Yarmouth Road (Yarmouth)	5,207	(1994)
Station Avenue (Yarmouth)*	20,064	(2004)
Great Western Road (Yarmouth)	5,500	(2002)
Main Street (Dennis)	841	(1998)
Route 134 (Dennis)*	26,485	(1996)

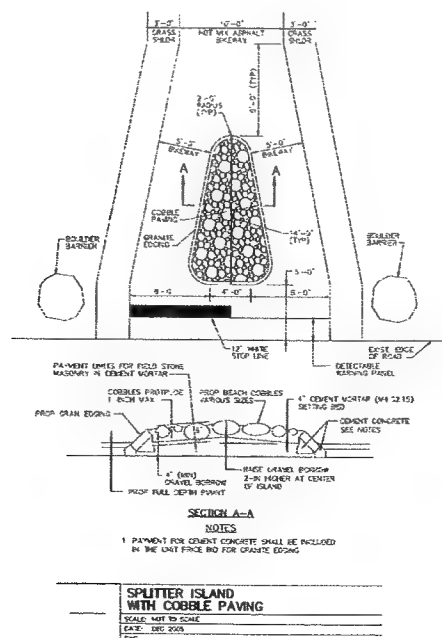
Of the roads listed above, three identified with an asterisk support substantial annual average daily traffic volumes in excess of 20,000 vehicles per day. For this reason, the evaluations of these locations have focused on grade separation alternatives including bridges and tunnels. Consideration for grade separations at these locations is appropriate with respect to pedestrian safety. As stated above, precedence was established for use of grade separation structures as there are numerous locations where the existing CCRT includes tunnels or bridges at intersections of roads with significant volumes.

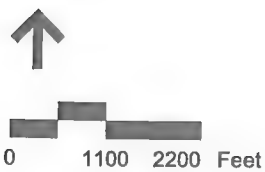
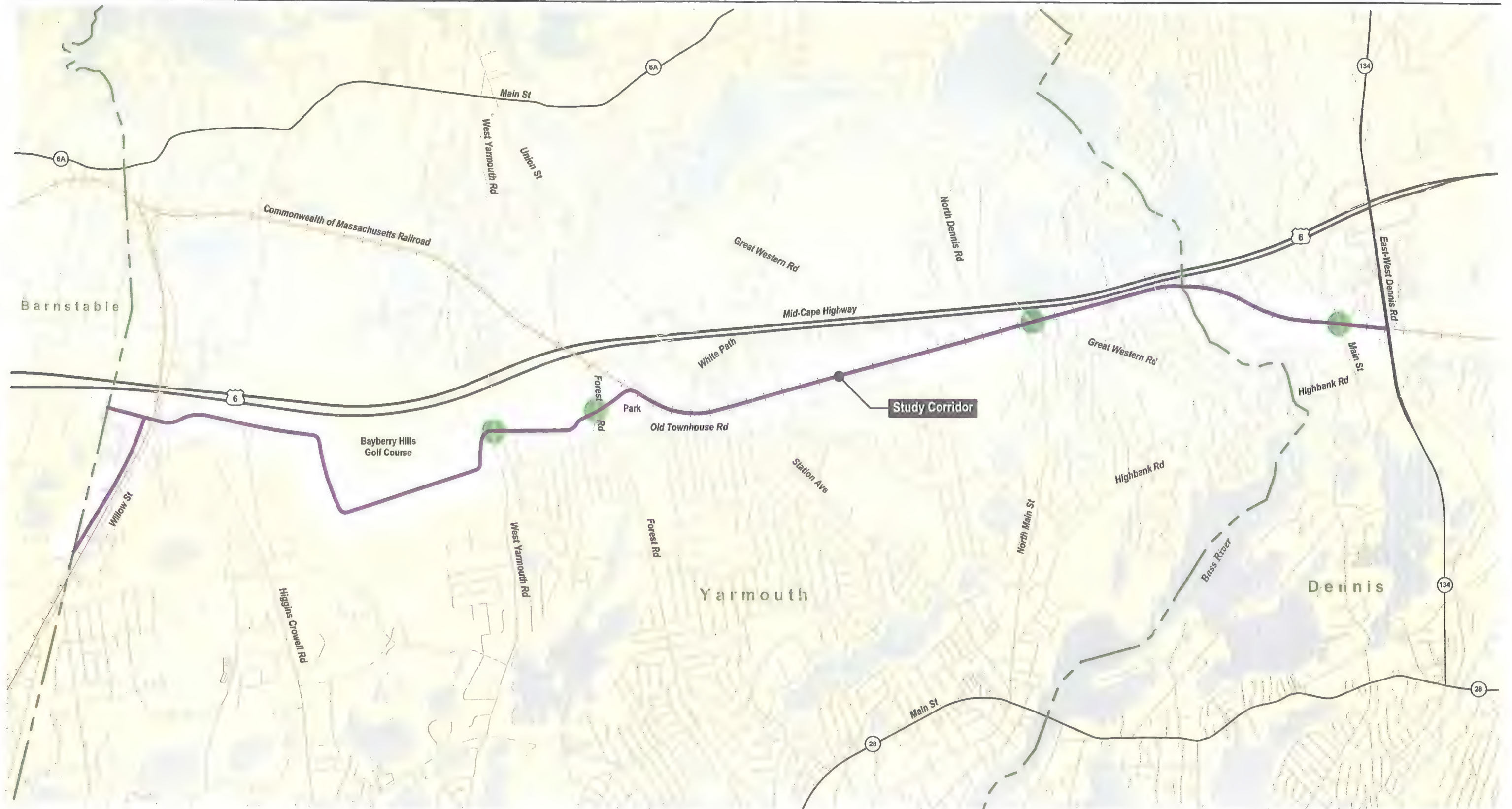
The remaining intersections are candidates for at-grade crossing.

At-grade Intersection Crossings

As outlined above, the study area intersects seven public roads. Four of these roads do not support significant level of traffic to warrant grade separation; therefore, pedestrians must negotiate a safe at-grade road crossing (see Figure 7 for the locations of at-grade crossings). Path-Road intersections are considered the most critical safety issue along a multi-use path. A variety of design techniques are recommended to alert both the motorist and path user of the special care required to assure safety at these crossings. The major design techniques recommended for the four road crossings are as follows:

- **Intersection Geometry:** The design of path horizontal geometry on the approach to a roadway should be designed to obligate the cyclist to react to a change in direction. This is accomplished with the use of a splitter island as depicted below. The splitter island combined with advanced 'intersection ahead' signs alert the cyclist to a change in condition that requires special care. The splitter island is constructed with large boulders on the outside and a raised cobble island central island to discourage access by unauthorized vehicles.





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Figure 7

At-Grade Crossings

Cape Cod Rail Trail Extension
Dennis & Yarmouth, Massachusetts



- **Intersection Signs and Markings:** Advanced pedestrian crossings signs are required on the roadway approaches to the path crossing. Crosswalk pavement markings are also required. Residents in attendance at the public meeting also suggested that the red brick pavement treatment use at the high school crossings on Station Avenue in Yarmouth should be considered at the project crossings to further enhance the visibility of the crossing.
- **Visibility:** Roadside vegetation will be cleared on roadway approaches and departures to assure no less than 325 feet of sight distance at all locations. Low profile, native species will be planted in the new sight shelves to avoid encroachment of vegetation in the future. Also, the towns should coordinate with the local street light company to increase average illumination at the crossings by placing high-intensity lamps at each crossing to increase visibility at dawn and dusk.



Grade-separated Crossings

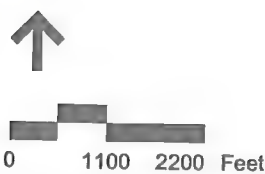
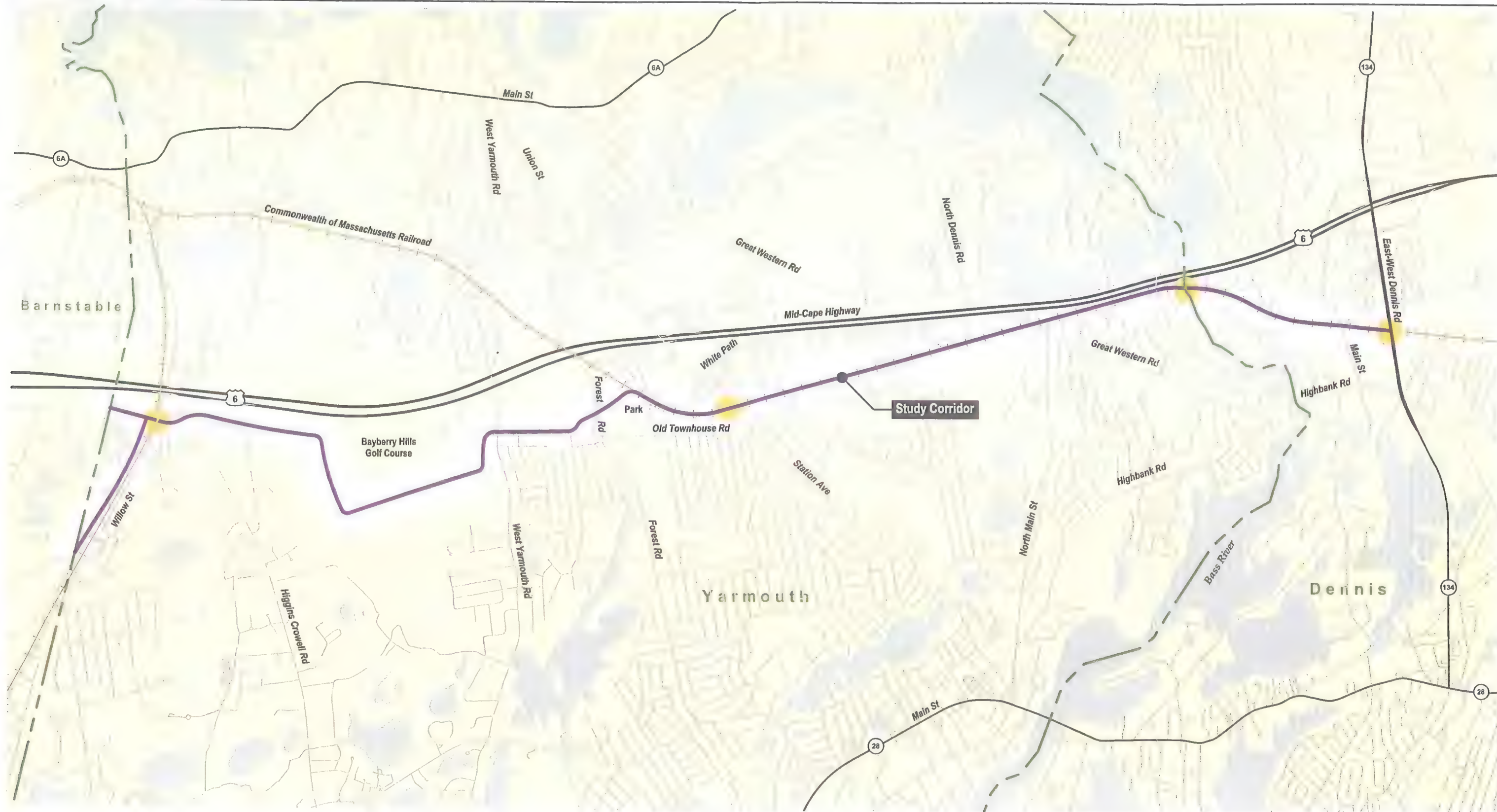
Along this proposed bicycle trail, certain locations require grade-separated structures to traverse over existing roads with high traffic counts, as well as bodies of water.

This section will incorporate site visits and preliminary engineering investigations to evaluate crossing alternatives required at areas where an at-grade crossing would not be feasible. Thought will be given to constructability, traffic impacts, safety, and aesthetics. A cost comparison will then be performed for each crossing location, comparing feasible alternatives for each site.

The candidates for grade-separated crossings are as follows:

- Route 134, Dennis
- Bass River, Dennis/Yarmouth
- Station Avenue, Yarmouth
- Willow Street, Yarmouth

See Figure 8 for the locations of grade-separated crossings.



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Figure 4.8

Grade Separation Crossings

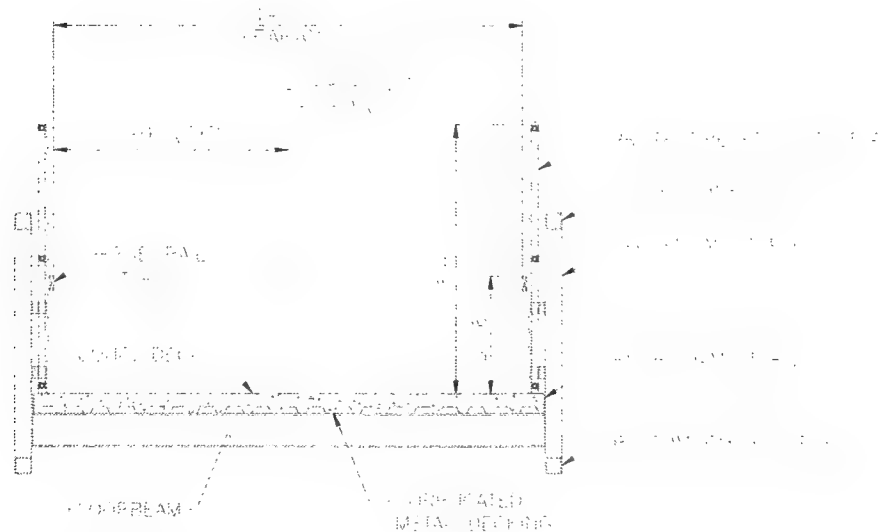
Cape Cod Rail Trail Extension
Dennis & Yarmouth, Massachusetts

Design Criteria

The proposed grade separated crossings will be designed in accordance with the AASHTO Guide Specification for Design of Pedestrian Bridges, the AASHTO Standard Specifications for Highway Bridges, 17th Edition, the MassHighway Bridge Manual, 2005 Edition, and the American with Disabilities Act (ADA). The proposed crossings will conform to the following geometry:

- Minimum cross-section width of 14 feet
- Maximum design speed of 30 miles per hour
- Maximum allowable bikeway gradient of 5%, as required by the ADA

The bridge will be designed to carry a minimum uniform live load of 85 pounds per square foot or H15 loading (emergency vehicle) which ever produces the greater load. Rub rails, required on both sides of the bridge, will be a minimum of 3'-6" high, and designed in accordance with AASHTO Standard Specifications for Highway Bridges, 17th Edition. Protective fencing (8 ft high) will also be provided over roadways as required by the MassHighway Department Development and Design Guide.



Typical Bridge Cross Section

Alternative Selection Criteria

Grade separation at crossings can be achieved by using either bridges or tunnels. Both offer their own, individual, set of benefits and challenges. The selection of the appropriate structure for each individual crossing site will be determined first from the following criteria:

- Individual location requirements
- Impacts of construction/staging
- Safety
- Aesthetics

Finally, among the crossing alternatives deemed theoretically feasible, construction costs will then be compared to determine the most cost-effective crossing alternative.

Individual Location Requirements

Each site must be reviewed to determine the impacts of a crossing on local and regional traffic, the abutters and the environment. For example, a tunnel structure would not be suitable for river crossings or at locations with a high water-table. Likewise, a bridge structure may not be feasible at a location in close proximity to an airfield, where FAA regulations may restrict structure heights. Each of the four sites that are included in this study has unique characteristics which must be considered when determining a preferred grade separated alternative.

Impacts of Construction/Staging

Second, during a typical construction season, (spring through late fall) traffic is heavy on the majority of roadways on the Cape. With a rich history of tourism and a large vacation population, road closures or even temporary lane reductions during construction would have a significant impact on residents and businesses. Safely maintaining existing roadways and minimizing traffic disturbances will play a large part in the choosing of an appropriate crossing structure. Structure types that can be constructed quickly and with minimal traffic disturbances will be much more heavily favored than a structure type that requires multiple roadway relocations or long-term closures.

Safety

Third, the proposed location of a particular crossing with respect to the surrounding landscape and local businesses will influence an alternative's viability. For instance, tunnels, in particular, pose their own unique set of safety concerns. The lack of visibility inherent in a tunnel structure may increase the likelihood of vandalism and other criminal activity. Safety mechanisms such as locked fencing at both tunnel openings as well as adequate lighting would be required. Likewise, this would require twice-daily visits from maintenance personnel, increasing long-term maintenance costs.

Aesthetics

Finally, the alternative chosen for a particular crossing location will have to offer a significant aesthetic value to the surrounding area. A structure's lifespan can encompass many decades, so it is important to choose an alternative that is a source of pride and admiration for the surrounding community.



Structural Alternatives – Underpass

A structural underpass can be a very effective means of providing grade separation. An underpass would provide the minimum visual impact to patrons on the street above as well as to the surrounding businesses. For a relatively narrow underpass such as what is required at the three street crossings, we were very quickly able to narrow our choices for structural alternatives. Given that street traffic must be maintained during construction, we limited our options to two different types of staged cut-and-cover tunnels. A jacked tunnel option may have been considered for shorter crossings if we did not have the ability to make use of the available right of way and move the traffic as necessary to allow for staged construction.

We have considered the following two tunnel alternatives:

- Precast concrete box culvert
- Corrugated steel tunnel

Depending on the geometry at each individual crossing, approach walls will be required to accommodate the bike path slope. The following is a general discussion/comparison of the alternatives in terms of staging and aesthetics. A cost comparison for each crossing will be included in the discussion of each individual location as part of the conclusion.

Impacts of Construction/Staging

Both tunnel alternatives would be constructed using the cut-and-cover method, which requires a significant amount of disruption to the street above and the surrounding businesses. Lanes will need to be shifted several times and utilities within the street would need to be relocated or shifted temporarily. Although the impacts of construction will be significant, they will be essentially identical for the two tunnel alternatives.

Aesthetics/User Comfort

As can be seen from the two photos on page 26, both options would provide an aesthetically pleasing underpass alternative. Both can be lighted to enhance user comfort, but the concrete box culvert tends to have cleaner lines and is often preferred from a purely aesthetic standpoint.

Alternative 1: Precast Concrete Box Culvert

This alternative involves the use of a precast box culvert to provide the required grade-separated crossing. The inside dimensions of the tunnel will be designed to provide adequate vertical and horizontal clearance for bike path users. Segment length would be dictated by lifting equipment capability, transportation load, and geometrics. Staged construction would be progressed by relocating traffic to allow the box culvert to be constructed in several segments that would be pieced together as traffic is moved from one side of the street to the other. Precast concrete wall and slab thickness would be in the range of 12 to 15 inches, depending on the depth below the roadway.



Precast Concrete Culvert Cross Section



Precast Concrete Box Culvert

Alternative 2: Corrugated Steel Tunnel

This alternative involves the use of a pre-fabricated steel tunnel system. The tunnel section would provide a minimum 14ft wide by 10ft high inside dimension. The staged construction approach would be very similar to the precast box culvert.



Corrugated Steel Pedestrian Tunnel Cross Section



Corrugated Steel Pedestrian Tunnel



Structural Alternatives - Overpass

There are numerous materials and structure types from which to select an appropriate bridge. Material choices range from the common: steel, concrete, and timber to less common types such as fiber reinforced polymer and fiberglass reinforced concrete. Demand and adoption of the less common materials have kept prices high, and the benefits of those materials do not justify the added cost for these applications. Therefore, material options considered in this investigation were limited to steel, concrete and timber.

The range of structure types is also numerous but the most practical options for the four locations evaluated are as follows:

- Alternative 1: Steel Thru-Girder
- Alternative 2: Prefabricated Steel Truss
- Alternative 3: Precast/Prestressed Concrete
- Alternative 4: Prefabricated Timber Truss

Depending on the geometry at each individual crossing, approach walls will be required to accommodate the bike path slope. The following is a general discussion/comparison of the alternatives in terms of staging and aesthetics. A cost comparison for each crossing will be included in the discussion of each individual location as part of the conclusion.

Impacts of Construction/Staging

The impacts of construction for Alternative 1 (Steel Thru-Girder) and Alternative 3 (Precast Concrete Box Beams) are almost identical. Both would require temporary closures of street traffic for erection of steel or concrete boxes. This would be a relatively short-term operation which could be completed over a couple of nights. Traffic would also need to be controlled while the concrete decks are formed and poured. Again, the preparation and construction of the deck would be accomplished by completing some work with controlled lane closures at night or by protecting the traffic below with barriers and fencing.

The impacts of Alternative 2 (Prefabricated Steel Truss) and Alternative 4 (Prefabricated Timber Truss) would be considerably less than that of the other two options. The prefabricated trusses would be delivered to the site in pieces, assembled on site, and erected in one piece, using a single nighttime closure of the street. Although this would require a significantly larger crane, the contractor should have adequate space for staging the crane within the adjacent bike path right of way.

Aesthetics/User Comfort

As can be seen from the example photos for the four alternatives below, each can provide an aesthetically pleasing bridge alternative. All alternatives are equal in

terms of user comfort therefore aesthetics would generally not play a large role in differentiating alternatives unless the Owner has specific preferences.

Alternative 1: Steel Thru-Girder

The steel girders would be placed across new cast-in-place concrete abutments and a concrete deck would be cast on top. Floor beams would span between the two girders and would provide the support for the concrete deck. It is recommended that the bridge be composed of weathering steel or painted to protect against the elements. Given the span lengths between 65 and 100 feet, a standard beam shape can be used as opposed to the cost premium associated with a custom built-up plate girder.



Steel Thru-Girder Bridge Cross Section



Steel Thru-Girder Bridge

Alternative 2: Prefabricated Steel Truss

A prefabricated truss is ideal for recreational and low volume vehicular applications. The efficiency of a truss maximizes the material strength, which cuts down on material costs. Trusses also have the added benefit of greatly enhancing the aesthetic impact of the crossing. It is recommended that the truss be composed of weathering steel or galvanized to protect against the elements.



Prefabricated Steel Truss Cross Section



Prefabricated Steel Truss

Alternative 3: Precast/Prestressed Concrete Beams

The construction sequencing for this alternative would be very similar to the steel girder option (Alternative 1). Four beams would be required to provide the required path cross section and beam sizes would vary based on span lengths.

A major concern with a concrete structure in Massachusetts is the harsh environment. Deicing salts coupled with a marine environment will tend to shorten the expected lifespan of the bridge. Corrosion will be a problem, and repairing prestressed concrete beams is a challenging effort. From an overall serviceability and aesthetic standpoint, this option would be the least desirable.



Precast Prestressed Box Beam Bridge Cross Section



Precast Prestressed Box Beam Bridge

Alternative 4 – Prefabricated Timber Truss

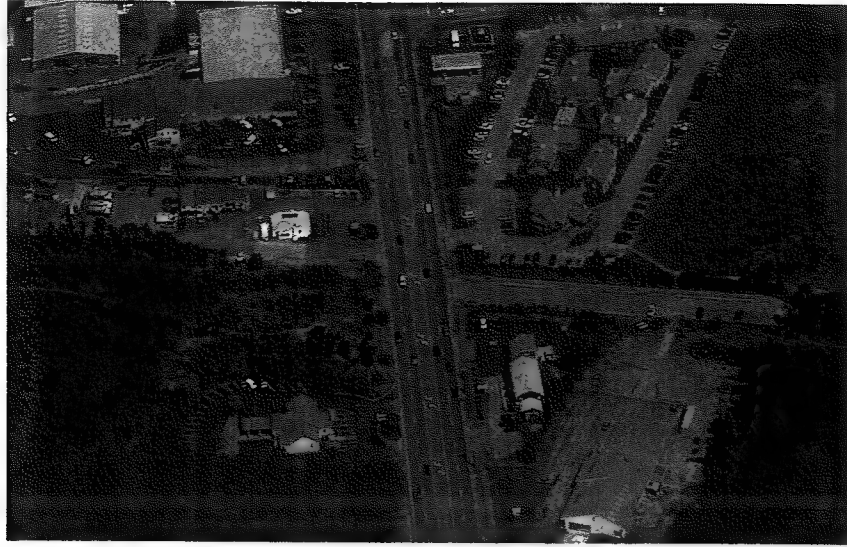
The construction of a timber truss bridge would be very comparable to the steel truss. Similar to the steel truss, quality would be very high as a result of shop fabrication and the construction schedule would be reduced since very little fabrication is required in the field. A drawback to the timber is that lifespan can be somewhat shorter than the steel alternative, whereas steel has about an 80-year lifespan; timber is typically closer to 60 years.

The timber would be pressure treated and would not be painted. The natural wood finish will add to the overall appearance of the bridge. Timber reacts better than steel or other building materials in the presence of salt and deicing chemicals and has the added benefit of being a sustainable and renewable resource. The large timber members would create a strong visual impression; however, given that the crossings require spans as long as 100 feet, it is not cost-effective for all locations.



Prefabricated Timber Bridge

Route 134 Crossing



Proposed Crossing Location @ Route 134

Roadway Characteristics, Adjacent Businesses and Existing Utilities

The Route 134 crossing is in a densely developed and busy commercial strip development. To the northeast and southwest of the crossing there are banks. Northwest there is an oil company and grill store, and to the southwest there is a bike shop and small commercial strip mall. There is also an above-grade power line across the southern edge of the crossing. The existing newly refurbished CCRT parking lot is to the east and the crossing will require some reconfiguration of the parking area to accommodate the grade-separated crossing and also the safe connection to the existing CCRT. The roadway is heavily traveled and five lanes wide including a shared turn lane. Route 134 is considered a major gateway to Dennis from Route 6.

The topography in the area of the proposed crossing is relatively flat. There are significant overhead utilities along Route 134 that will need to be modified to accommodate the crossing, as well as public water supply in the street. A crossing either above or below grade will require in excess of 100 feet in length not including required grade transitions. If a below-grade crossing is considered, lighting will be required as well as a special drainage design to address runoff into the tunnel from long grade transitions. The long tunnel could be considered a safety problem and this issue was raised by the Dennis Police as undesirable.

Although a bridge crossing would be highly visible, it could reinforce the gateway, and would not appear to be out of place with the existing adjacent commercial uses.

The bridge would be visible from the adjacent historic district and therefore the visual character of the bridge will need to be addressed. A bridge could be considered a positive by increasing the visibility of the rail trail. The crossing will require at-grade connections to pedestrian walkways so the public can gain access to adjacent commercial uses including several restaurants and publicly accessible restrooms. If a bridge structure is designed it will need to address the overhead utilities as well as visibility of signage for adjacent businesses. Since the existing CCRT parking area and rest stop is at this location, the crossing will have to be integrated with these uses as well as a potential parking lot replacement to the west of Route 134.

Geotechnical Information

At this time, a subsurface investigation at this location has not been performed. Prior to the advancement of a proposed design, it is recommended that a full-scale geotechnical investigation be performed to determine the subsurface conditions in the area and to make recommendations as to approach wall types and abutment foundation requirements.

Site Geometry

The proposed crossing site would have the following geometric constraints:

- Clear span = 100 feet
- Vertical clearance (on Path) = 10 feet
- Vertical clearance (over Roadway) = 16 feet, 6 inches
- Horizontal Clearance = 14 feet

Underpass Construction Costs

At Route 134, the main differentiator between the two tunnel alternatives comes in the construction costs. In this case, the ancillary costs like staging, utilities, and approaches would all be very similar; however, the material differences between the precast concrete box culvert and the corrugated steel are significant. The costs are summarized below:

Alternative 1 – Precast Concrete Box Culvert \$ 1,073,000

Alternative 2 – Corrugated Steel Invert Tunnel \$ 978,000

Although the corrugated steel tunnel has slightly lower initial costs, we have used the precast concrete box culvert for comparison to the preferred overpass alternative. The precast concrete box is generally preferred for aesthetics and for long-term durability.

Overpass Construction Costs

As discussed previously we have evaluated four different overpass alternatives for the Route 134 crossing. The main differentiator between the four bridge alternatives will be the construction costs. The costs are summarized below:

Alternative 1 – Steel Thru-Girder Bridge	\$ 1,007,000
Alternative 2 – Prefabricated Steel Truss	\$ 965,000
Alternative 3 – Precast Concrete Box Girders	\$ 978,000
Alternative 4 – Prefabricated Timber Truss.....	\$ 981,000

Although all four alternatives are somewhat cost neutral given the preliminary nature of this study, we believe Alternative 2 (prefabricated steel truss) to be a stronger option given the other advantages of using a prefabricated structure as previously described in the structural alternatives section. The construction of the prefabricated bridge superstructure also occurs within a very controlled environment, which often produces better quality construction. Given these advantages, we have used the prefabricated steel truss for comparison with the preferred underpass alternative.

Conclusion

The prefabricated steel truss has several significant advantages over the precast concrete tunnel option at the Route 134 crossing. The overpass option comes at a lower initial cost and the impacts of the staged construction required for an underpass are significant and would require a significant amount of disruption to the users of Route 134 and the surrounding businesses. Both options can provide a crossing that would be aesthetically acceptable to the public; however, any underpass option would need to consider user comfort in the design. Tunnels by nature can pose safety problems and be an area of concern for potential patrons. Tunnel construction can also be much more susceptible to cost overruns in construction, which is why we carry a higher contingency in our underpass estimates. The unknowns associated with construction below grade such as high water table, high rock, and poor soils are much more costly in a tunnel option than a bridge option.

Given the discussion above, we recommend the use of a prefabricated steel truss for the crossing at Route 134.

Bass River Crossing

The Bass River Bridge, visible from Route 6, represents a high-profile crossing on the Cape Cod Rail Trail. It differs from the other grade separations studied in that it spans the Bass River and has an existing structure which must be evaluated as part of this feasibility study.



Existing Bass River RR Bridge (looking south)

Existing Conditions

The existing bridge, which carried rail traffic over the Bass River, is a single-span riveted steel plate girder structure. The girders are roughly 64 feet long and span a channel width of roughly 62 feet. The bridge does not support any utilities and the age is unknown. A visual inspection revealed the bridge to be in fair to poor condition. The existing vertical and horizontal alignment, which is relatively flat and straight, will be maintained as part of any future bike path construction.



Existing Plate Girder Bridge

The approaches, primarily sand fill, are retained by stone block wingwalls extending parallel from the stone block abutments. The slopes on both sides of the bridge have eroded significantly, exposing the back of the wingwalls.



Erosion of Approach Slope Behind Wingwalls

Wingwall mortar has deteriorated in some locations and displacement of the granite masonry has occurred. This is particularly evident at the tops and ends of the wingwalls. Above the tidal zone, the mortar is still in good shape and very little displacement of the stones has occurred.



Deterioration in Wingwall Ends

The narrowing of the Bass River at the bridge results in higher water velocities under the bridge and reduced tidal flushing in the upper Bass River. This constriction and subsequent increased water velocity is contributing to the erosion of the approach slopes. In addition, reduced tidal flushing has resulted in algae blooms and shellfish bed closure due to accumulation of high coliform counts from storm water run-off.

Geotechnical Information

Typical subsoil conditions on the Cape are characterized by glacial deposits of sand and gravel. However, in many estuary and river locations, subsurface conditions contain a large quantity of clay, organic silt, and weak sands. The visual inspection of the existing structure showed little evidence of settlement and for this reason it has been assumed that the bridge sits atop competent material.

Site Geometry

The proposed crossing site would have the following geometric constraints:

- Clear span = 64 feet
- Vertical clearance (on Path) = 10 feet
- Vertical clearance (over Bass River) = Match Existing Vertical Clearance
- Horizontal Clearance = 14 feet

Overpass Alternatives

As discussed previously, we have evaluated four different overpass alternatives for the Bass River Crossing. For this crossing only, we have also evaluated the option of rehabilitating the existing structure. One of the main differentiators between the five bridge alternatives will be the initial construction costs. We have assumed that the existing substructure will be rehabilitated for all options. The following summarizes the construction costs:

Alternative 1 – Steel Thru-Girder Bridge	\$252,000
Alternative 2 – Prefabricated Steel Truss	\$275,000
Alternative 3 – Precast Concrete Box Girders	\$255,000
Alternative 4 – Prefabricated Timber Truss.....	\$286,000
Alternative 5 – Rehab of Existing Superstructure.....	\$260,000

Substructure Repair

Given the generally good condition of the existing bridge substructure, an affordable rehabilitation is feasible. This would require the displaced stones at the ends of the wingwalls will need to be reset and deteriorated mortar will have to be re-pointed. Stabilizing the approach slopes is also an important rehabilitation measure. Not only will the slopes have to be re-graded to replace soil that has washed away, but also slope protection will have to be constructed. It may be necessary to construct a rip-rap toe or other revetment structure to prevent slope erosion from occurring again.

Conclusion

While every alternative investigated for this crossing offers a generally economical choice, consideration was made with regard to constructability, ease of maintenance,

longevity, and aesthetics. In summary, while the steel girder alternative was the least expensive, when compared to the prefabricated truss it requires more construction time and does not have the advantages of shop fabrication as discussed in the structural alternatives section. The precast, prestressed box beam options are susceptible to deterioration from deicing salts and the marine environment and are also more difficult to rehabilitate. The rehabilitation option is cost competitive with the other options; however, we recommend providing a new superstructure consistent with other crossing locations. Also, a certain amount of structural steel will be required to replace the deteriorated elements, and these costs can not be accurately determined without a more detailed inspection.

Both the steel truss and timber truss superstructure options could provide a beautiful river crossing. The steel option is more economical in terms of initial construction costs and is more durable with a lifespan of about 80 years as opposed to the timber option, which has a life span of about 60 years. Ultimately, the efficiency, cost-effectiveness and consistency with other crossing recommendations make a prefabricated steel truss the best choice for this crossing. This crossing's unique location has the potential, by means of an aesthetic and functional bridge, to enhance the beauty of the surrounding area for years to come.



Station Avenue Crossing



Proposed Crossing Location @ Station Avenue

Roadway Characteristics, Adjacent Businesses, and Existing Utilities

The Station Avenue crossing is in a densely developed and busy commercial strip development. To the north of the crossing there is a small wooded buffer and large shopping center to the northeast, and strip commercial to the northwest and southwest. To the southeast there is a gas station and small office building and



Dunkin Donuts. The roadway is heavily traveled and three lanes wide including a shared turn lane. Station Avenue is considered a major gateway to Yarmouth from Route 6.

The topography in the area of the proposed crossing is very flat and there is significant room for the grade-separated crossing. The Railroad ROW has close commercial development on the east side and is less developed to the west. There are overhead utilities along the roadway as well as municipal water in the street. A crossing either above or below grade will require in excess of 85 feet in length not including required grade transitions. If a below-grade crossing is considered, lighting will be required, as well as a special drainage design to address runoff into the tunnel from long grade transitions. The long tunnel could be considered a safety problem and this issue was raised by the Yarmouth Police as undesirable.

Although a bridge crossing would be highly visible, it could reinforce the gateway and would not appear to be out of place with the existing adjacent commercial uses. In addition, it could increase the visibility of the rail trail. The crossing will require at grade connections to pedestrian walkways so the public can gain access to adjacent commercial uses including several restaurants and publicly accessible restrooms. If a bridge structure is designed, it will need to address the overhead utilities as well as visibility of signage for adjacent businesses. Since a large parking area and rest stop is also proposed at this location, the crossing will have to be integrated with these uses.

Geotechnical Information

At this time, a subsurface investigation at this location has not been performed. Prior to the advancement of a proposed design, it is recommended that a full-scale geotechnical investigation be performed to determine the subsurface conditions in the area and to make recommendations as to approach wall types and abutment foundation requirements.

Site Geometry

The proposed crossing site would require the following geometric constraints:

- Clear span = 86 feet
- Vertical clearance (on Path) = 10 feet
- Vertical clearance (on Roadway) = 16 feet, 6 inches
- Horizontal Clearance = 14 feet

Underpass Construction Costs

Similar to the Route 134 crossing, the main differentiator between the two tunnel alternatives comes in the construction costs. In this case, the ancillary costs like staging, utilities, and approaches would all be very similar; however, the material differences

between the precast concrete box culvert and the corrugated steel are significant. The costs are summarized below:

Alternative 1 – Precast Concrete Box Culvert \$ 983,000

Alternative 2 – Corrugated Steel Invert Tunnel \$ 919,000

Although the corrugated steel tunnel has lower initial costs, we have used the precast concrete box culvert for comparison to the preferred overpass alternative. The precast concrete box is generally preferred for aesthetics and long term durability.

Overpass Construction Costs

As discussed in the structural alternatives section, we have evaluated four different overpass alternatives for the Station Avenue Crossing. The costs are summarized below:

Alternative 1 – Steel Thru-Girder Bridge..... \$ 919,000

Alternative 2 – Prefabricated Steel Truss \$ 911,000

Alternative 3 – Precast Concrete Box Girders \$ 914,000

Alternative 3 – Prefabricated Timber Truss..... \$ 924,000

Although the first two alternatives are somewhat cost neutral given the preliminary nature of this study, we believe Alternative 2 (prefabricated steel truss) to be a stronger option given the lesser impact to Station Avenue and the surrounding businesses. The construction of the prefabricated bridge superstructure also occurs within a very controlled environment, which often produces better quality construction. Given these advantages, we have used the prefabricated steel truss for comparison with the preferred underpass alternative.

Conclusion

Although the costs for the prefabricated steel truss are fairly close to the costs for the precast concrete box culvert, there are several advantages to staying with a bridge option at Station Avenue. The impacts of the staged construction required for an underpass are significant and would require a significant amount of disruption to the users of Station Avenue and the surrounding businesses. Both options can provide a crossing that would be aesthetically acceptable to the public; however, any underpass option would need to consider user comfort in the design. Tunnels by nature can pose safety problems and be an area of concern for potential patrons. Tunnel construction can also be much more susceptible to cost overruns in construction, which is why we carry a higher contingency in our underpass estimates.

Given the discussion above, we recommend the use of a prefabricated steel truss for the crossing at Station Avenue.

Willow Street Crossing

The Willow Street crossing is unique in that the trail alignment crosses Willow Street as well as an adjacent active railroad. There are two options shown for path alignments that cross Willow Street. Based on feedback which has already been received from the Town of Yarmouth and the public, we have proceeded with evaluating only the option at Higgins Crowell Road.



Proposed Crossing Location along Willow Street @ Higgins Crowell Road

Roadway Characteristics, Adjacent Businesses and Existing Utilities

The Willow Street crossing is proposed in the location of the old Higgins Crowell Road intersection with Willow Street that was relocated at a signalized intersection 1000 feet south of this location. To the southeast is the MassHighway maintenance facility and to the northeast is the ramp to Route 6. North is the Route 6 overpass and to the west is an active rail line for the Cape Cod Dinner Train, and undeveloped lands owned by the Town of Yarmouth. To the southwest beyond the rail line is the Yarmouth Campgrounds property. The crossing will require crossing of four travel lanes of traffic as well as the active rail line. The topography in this location is rolling with higher grades on both sides of Willow Street, allowing for potentially shorter transitions for an above-grade crossing. The crossing will require approximately a 160-foot span. Although there are now sidewalks along Willow Street, the route is utilized by bicyclists heading north and south along Willow Street and an at-grade pedestrian connection to Willow Street on the east side should be considered in the crossing design.

Airport Proximity

The proposed crossing location at Willow Street is in the proximity of Barnstable Municipal Airport and therefore needs to be reviewed for vertical constraints associated with airport traffic. We have reviewed the Federal Aviation Regulations (FAR) Part 77 surfaces in the area of the proposed crossing and have found that a proposed overpass would not violate the Part 77 surfaces and therefore constructing the overpass would not require reporting to the FAA. See the attached drawing (FAR Part 77 Surfaces Review).

Geotechnical Information

At this time, a subsurface investigation at this location has not been performed. Prior to the advancement of a proposed design, it is recommended that a full-scale geotechnical investigation be performed to determine the subsurface conditions in the area and to make recommendations as to approach wall types and abutment foundation requirements.

Site Geometry

The proposed crossing site would have the following geometric constraints:

- Clear span = 160 feet
- Vertical clearance (on Path) = 10 feet
- Vertical clearance (over Roadway) = 16 feet, 6 inches
- Vertical clearance (over Rail) = 22 feet, 6 inches
- Horizontal Clearance = 14 feet

Underpass Alternatives

We have eliminated the use of an underpass alternative at this crossing for the following reasons:

1. The topography adjacent to Higgins Crowell Road lends itself to an overpass.
2. The tunnel would need to be constructed under the active rail line which would make staging much more complex.
3. The tunnel would need to be 160 feet long and transitions would be even longer given that we are working against the local topography. This would heighten the safety concerns already expressed by the Towns.

Overpass Construction Costs

As discussed previously we have evaluated four crossing alternatives for the Willow Street crossing. Given the 160 foot clear span we have evaluated options which utilize a center pier located between the roadway and railroad (2 – 80 foot spans). The costs are summarized below:

Alternative 1 – Steel Thru-Girder Bridge.....	\$ 1,294,000
Alternative 2 – Prefabricated Steel Truss	\$ 1,266,000
Alternative 3 – Precast Concrete Box Girders	\$ 1,285,000
Alternative 4 – Prefabricated Timber Truss.....	\$ 1,293,000

Although all four alternatives are somewhat cost neutral given the preliminary nature of this study, we believe Alternative 2 (prefabricated steel truss) to be a stronger option given the other advantages of using a prefabricated structure as described in structural alternatives section above. The construction of the prefabricated bridge superstructure also occurs within a very controlled environment, which often produces better quality construction.

Conclusion

The prefabricated steel truss has several significant advantages for the Willow Street crossing. The prefabricated steel option comes at a lower initial cost and the advantages of the quicker construction are more important given that we are crossing a railroad as well as Willow Street. The topography at the site favors an overpass option and it should not have an impact on the adjacent Barnstable Municipal Airport. As discussed previously, the tunnel option is not practical at this crossing; therefore we recommend the use of a prefabricated steel truss for the crossing at Willow Street.

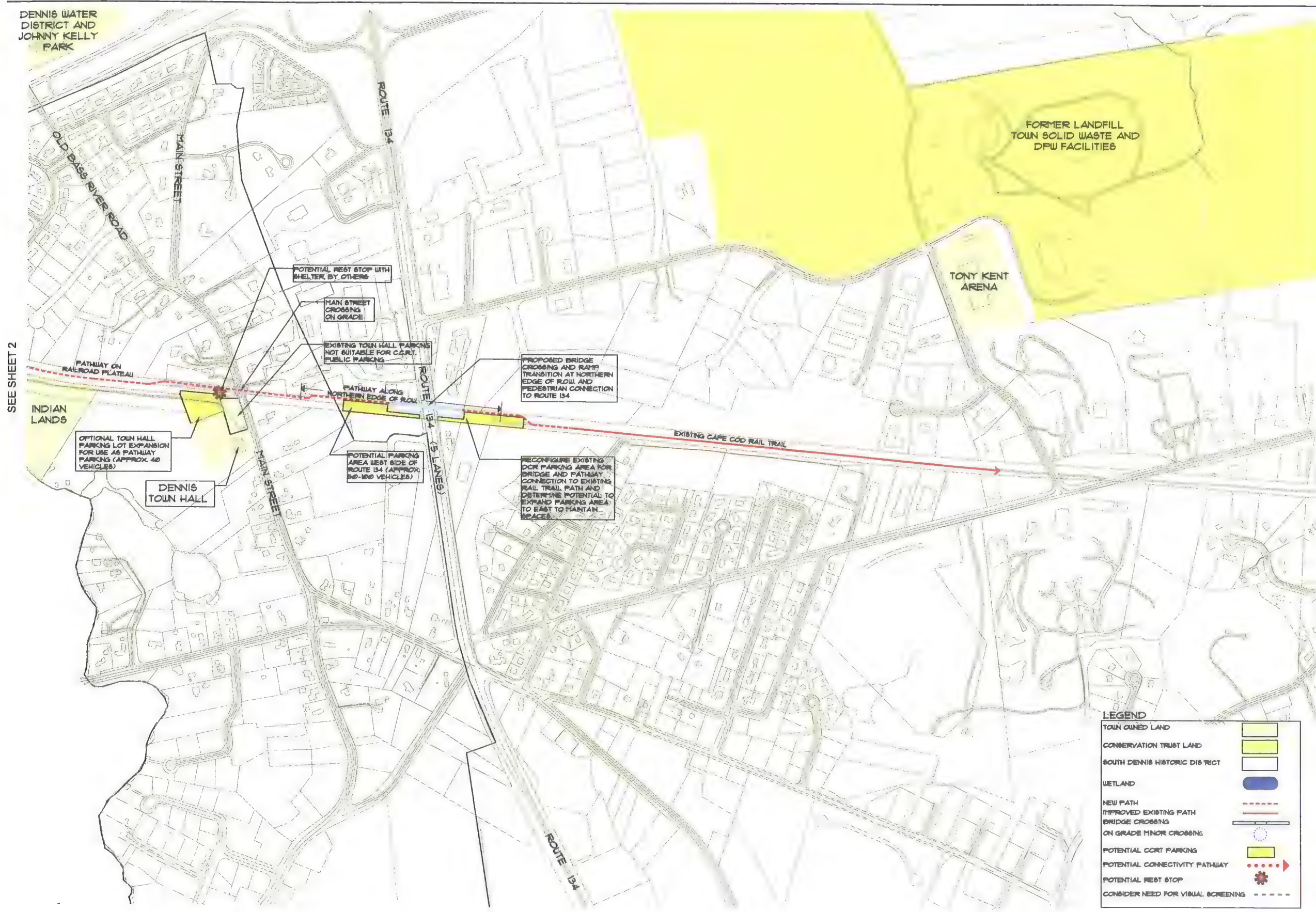
Pathway Alignment Considerations, Rest Stop and Parking Opportunities

For much of the proposed route the CCRT extension will be constructed in the center of the existing railroad right of way and replace the existing tracks. However, the path alignment will not always be in the middle of this right of way or even in the right of way and may vary to minimize impacts on adjacent land uses, control storm water, share use with the active rail line or provide pathway access as well as the accommodate rest stops and parking. The rail trail will need parking as well as rest stops to support potential users. The Massachusetts Highway Department (MassHighway) insists that parking lots be included as part of the CCRT extension. There are locations on the CCRT extension where new parking lots are proposed and where existing parking might be utilized and improved to accommodate CCRT users. Based on the existing conditions analysis and public meetings Schematic Design Considerations plans were developed to identify potential pathway alignment and logical areas for parking and rest stops and assist the public understand how the pathway and support activities might be configured. The location of the parking lots were chosen based on availability of space, minimal impact on abutters, and ease of accessibility from major routes. In most cases the parking lot locations may also be designed as rest stops for CCRT users. At each parking lot and road crossing where vehicles are present there will be a need for vehicular control. This can be accomplished through the use of bollards, gates, or

raised pavement. The Schematic Design Consideration plans will serve as the basis for the preliminary design of the pathway, parking and rest stop improvements and are illustrated in Figures 8 through 12. MassHighway encourages the use of granular pervious surfacing rather than impervious surfaces such as bituminous concrete or asphalt. The exact design of these lots will need further consideration to provide for pervious surface but also minimize maintenance activities of the areas from vehicle use. One option might be to pave the parking lot isles but utilize crushed stone for the parking bays. Guard rails and bollards will also be important considerations to control vehicle access.

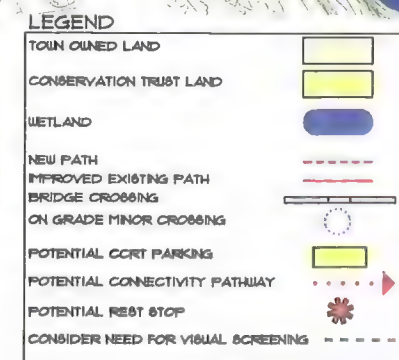
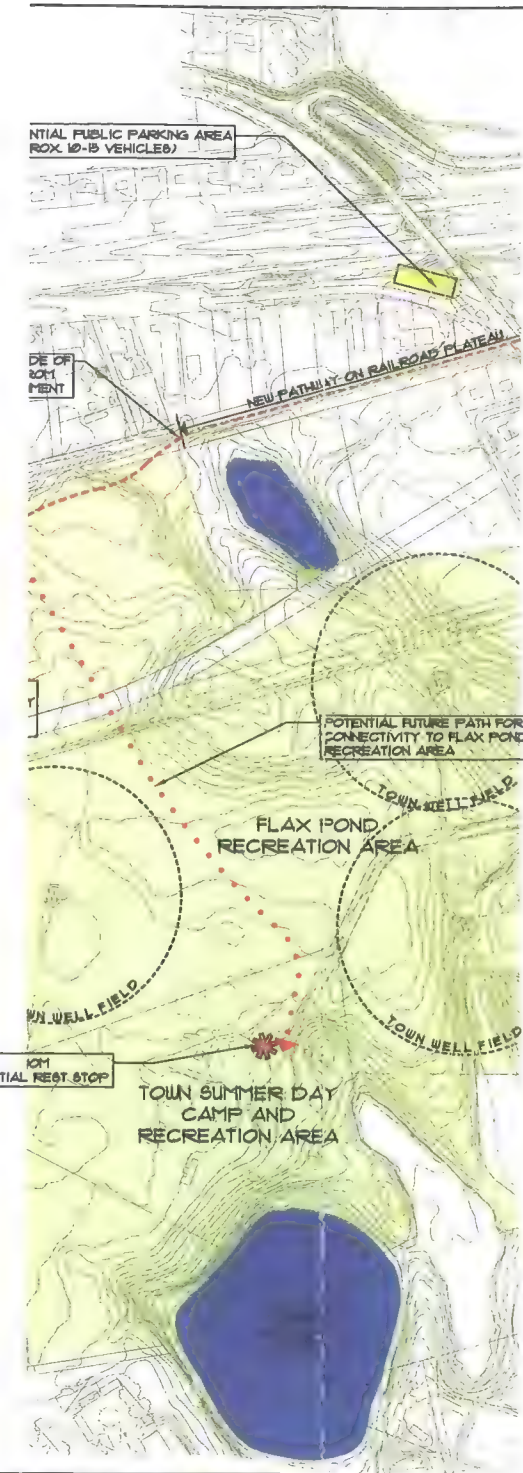
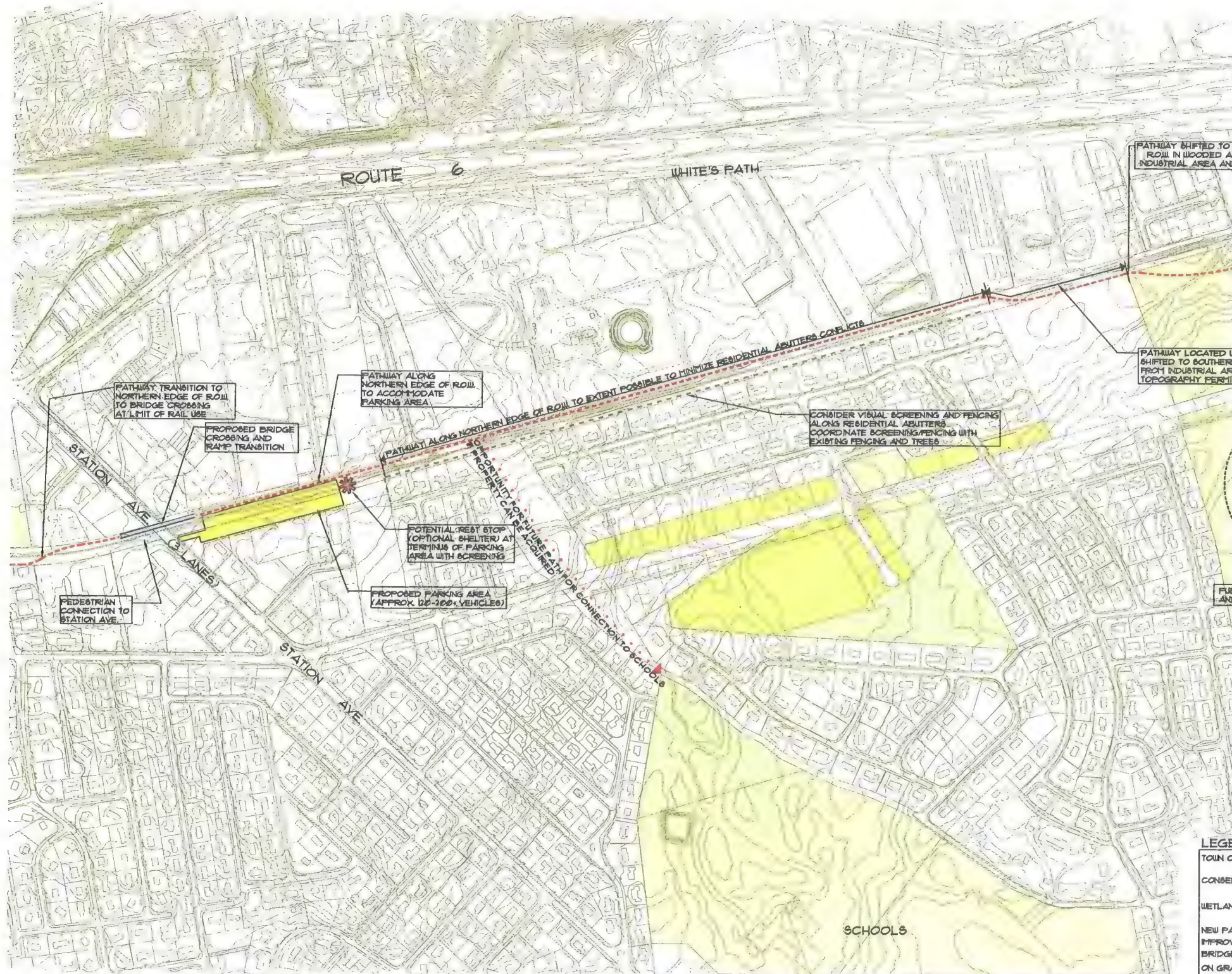
Where the extension will begin, at Route 134 in Dennis, the pathway will need to be constructed through the newly constructed DCR CCRT parking area and connect to the existing trail. The bridge crossing of Route 134 will also require some parking lot disturbance and will likely impact parking lot circulation and access as well as the number of spaces. Due to the overhead power lines to the south, the proposed pathway alignment is envisioned along the northern edge of the right of way. This is anticipated to allow enough room to reconfigure the current DCR parking lot and provide for the pathway connection to the existing DCR trail. On the west side of Route 134 a potential parking lot could be constructed to replace any lost spaces in the DCR lot. The new parking lot could potentially accommodate 50 to 100-plus vehicles within the Railroad ROW as well as the bridge abutments and pathway grade transition should parking lots exist on both sides of Route 134; however, a physical barrier should be installed on the centerline of Route 134 to prohibit circulation back and forth between these lots to minimize impacts to safety and level of service in the public way. The pathway beyond Route 134 will transition to the center of the ROW to avoid some existing warehouse structures build abutting the northern property line. As the pathway approaches Main Street the pathway is proposed to transition to the northern edge of the ROW to reduce impacts on the adjacent residential property and maximize space adjacent to the parking area by Dennis Town Hall and provide a location for potential rest stop and shade shelter. At the Town Hall there is an existing parking lot that might be expanded and used by CCRT users. The bike path is then anticipated to transition to the center of the ROW, all the way to the Bass River crossing, with minor variations in the alignment to accommodate access and drainage. The old Route 6 rest stop area, owned by the state, has been identified as a potential future parking area for the rail trail with direct access to Route 6. This location, with high visibility and direct access to Route 6, could provide parking for several hundred vehicles, but would have to be modified to limit potential impacts to abutting residential areas as well as improved access and egress. MassHighway has indicated that they will not support a new exit/destination on Route 6 and recommended that this parking lot be considered as a future option. A rest stop at the Bass River Crossing is proposed to take advantage of the water views as well as fishing opportunities.

From the Bass River Crossing the pathway will be on the railroad plateau in Yarmouth until crossing North Main Street. Where White's Path meets North Main Street there is a small space for a parking lot that may accommodate 10 to 15 vehicles. This location could allow trail users to park close to the CCRT extension route while



SEE SHEET 2

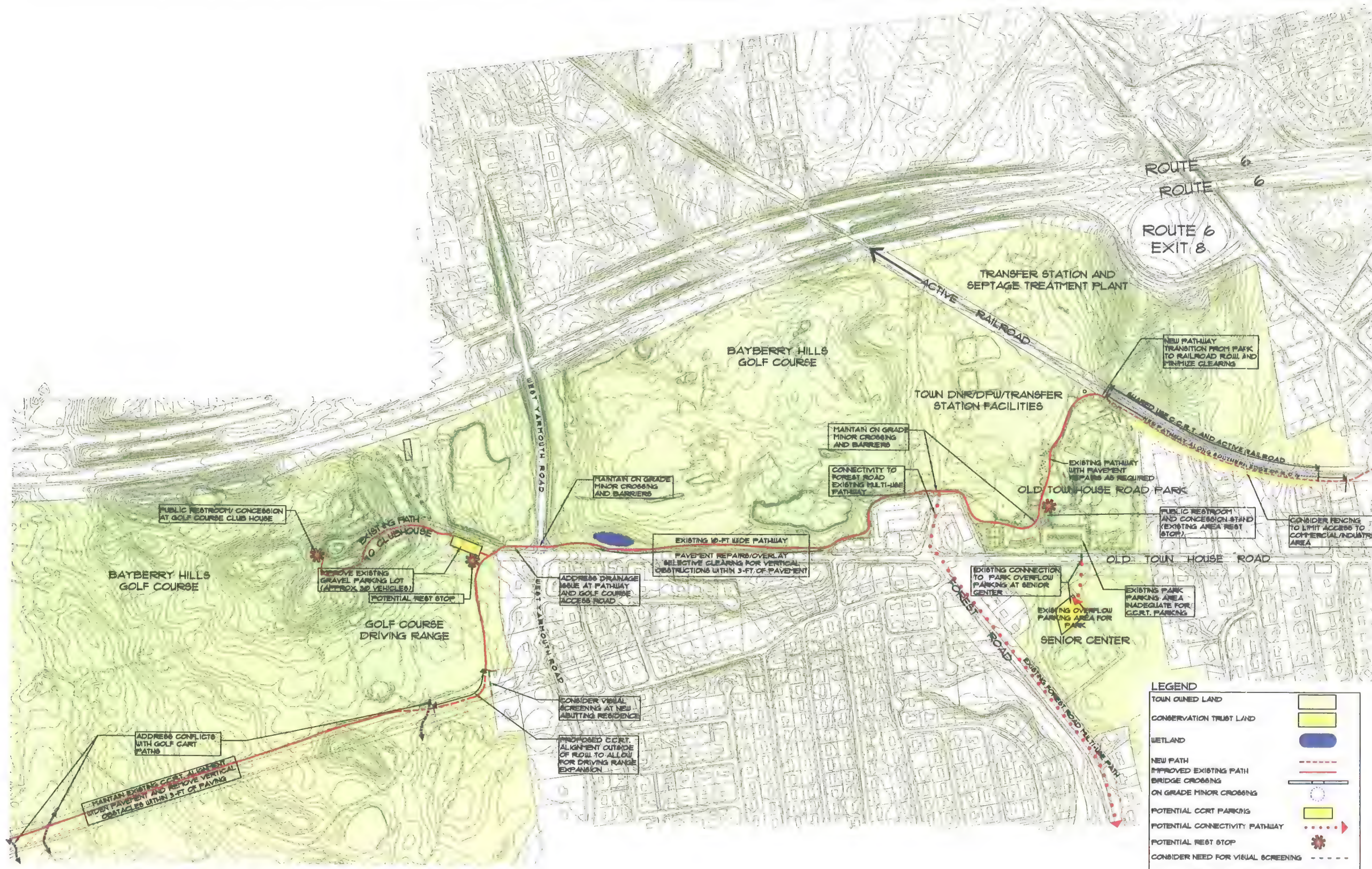
Figure 8
Proposed Conditions 1



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Figure 10
Proposed Conditions 3

Cape Cod Rail Trail Extension
Dennis & Yarmouth, Massachusetts



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Figure 11
Proposed Conditions 4

Cape Cod Rail Trail Extension
Dennis & Yarmouth, Massachusetts



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Figure 12
Proposed Conditions 5

Cape Cod Rail Trail Extension
Dennis & Yarmouth, Massachusetts



still being close to Route 6. Beyond North Main Street in the area of the town DPW Water Division lands a pathway connection is proposed to Flax Pond Recreation Area, where public restrooms are available. At this location, due to encroachment of industrial uses on the northern edge of the ROW, the pathway is proposed to transition south, outside of the right of way, into the Town-owned wooded area to provide a buffer from the noise, dust and visual impacts of the industrial uses. As the pathway leaves the Town-owned land it will transition back to the northern edge of the right of way. This is to minimize conflicts with the residential abutters of the Beacon Street neighborhood. The exact alignment of the pathway in this area will be dependent on grade requirements and transitions and will require review with the abutters who have indicated the importance of minimizing visibility and impacts of the pathway on their abutting properties along the southern edge of the ROW. The pathway is proposed to stay along the northern edge of the right of way until Station Avenue. Before reaching Station Avenue the Railroad ROW is very wide, providing an excellent opportunity for a parking lot that could accommodate 100 to 200 vehicles. A potential rest stop could occur to the east of this parking lot. The Station Avenue above-grade crossing is envisioned to be along the northern edge of the ROW with ample area for grade transition on either side of Station Avenue.

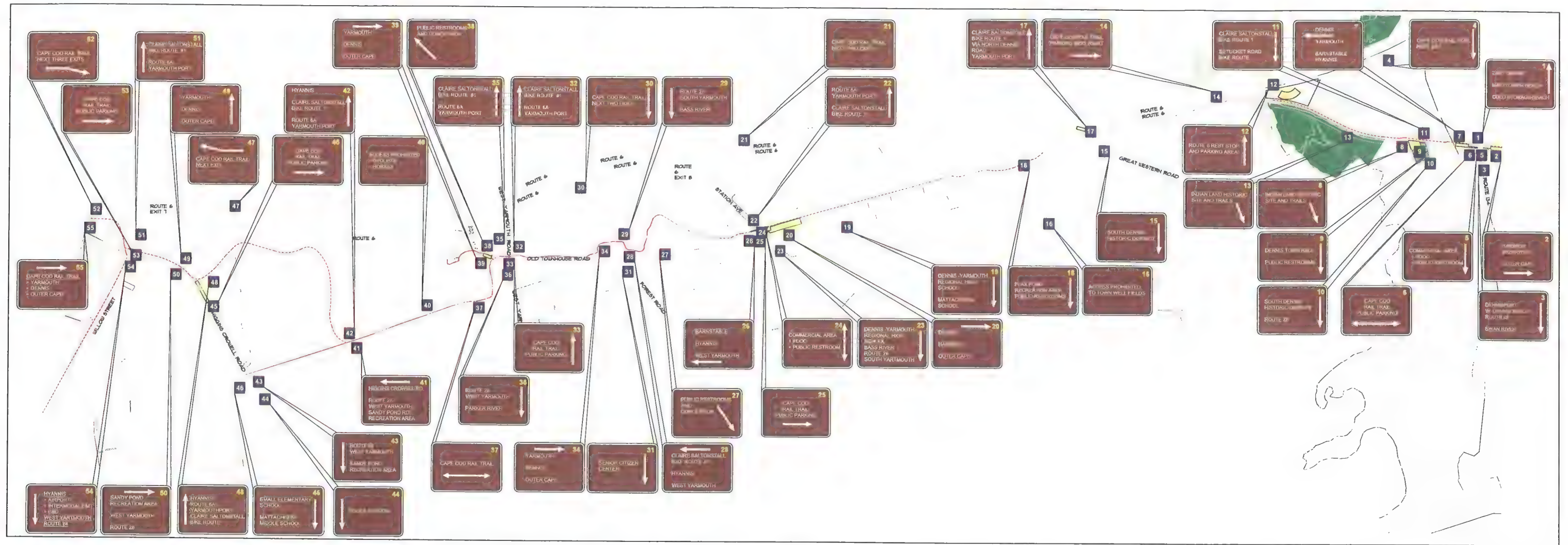
On the west side of Station Avenue the pathway transitions to the southern edge of the right of way. This transition to the south is required to allow the path to share the right of way with the active railroad serving the transfer station. The pathway will share the right of way until it connects to the existing pathway located at Old Townhouse Road Park. Starting at the Park, a 10-foot pathway has been constructed. The pathway, constructed in 1999, will need some reconstruction and clearance to vertical elements along the pathway will also need to be addressed. There is an existing 110-vehicle parking area for Old Townhouse Road Park. The existing parking area for the park is not adequate to accommodate CCRT users. However, there is an overflow parking area adjacent to the senior center on the south of Old Town House Road that could be utilized. The park has a restroom concession stand and also picnic tables and benches. Additional rest stop improvements should be considered at this location. The 10-foot paved pathway continues parallel to Old Town House Road to the south and the Yarmouth transfer station and Bayberry Hills Links Golf Course. And will require some improvements to the pavement and sideline clearances including the relocation of guardrail along Old Town House Road. There is an existing gravel parking lot along the entrance drive to the golf course just west of West Yarmouth Road. This parking lot was constructed for use with the existing pathway and could be improved to allow for some use by CCRT users. A potential rest stop could also occur in this area with some way finding signs to the golf course clubhouse which contains restrooms and a concession area.

From the existing pathway, width is reduced to 8-½ feet and is in need of box-widening and pavement overlay due to narrow width, pavement condition and clearances along the pathway. The proposed alignment will follow the existing pathway through Bayberry Hills Golf Course. At one point along this section there may be the need to divert the path from its current alignment near the golf course driving range to allow for the possible expansion of the driving range. There are several golf course cart path crossings of the proposed CCRT route and these crossings

will need to be addressed to insure safety of both trail users and golfers. The pathway will continue along the existing pathway alignment until reaching the Town of Yarmouth DPW Water Division property. From here a northern pathway alignment is proposed that will traverse the town of Yarmouth property to the old Higgins Crowell Road ROW. At the old Higgins Crowell Road ROW, the pathway will be constructed on the old Higgins Crowell Road that is currently only used by the town for well field and pump station access and travel northwest to Willow Street. To the south where the pathway meets the old Higgins Crowell Road there is a potential for a parking area for approximately 100 vehicles that would connect to Higgins Crowell Road located just north of the new round-about. This location would also be an excellent rest stop location. This parking lot could also serve as a "starting point" for CCRT users to begin their use of the trail due to its close proximity to Willow Street and Route 6 exit. The proposed pathway alignment will follow the old Higgins Crowell Road to Willow Street. At Willow Street an above-grade crossing is proposed. From here the pathway could connect to the two CCRT extension routes planned by the Town of Barnstable. The northern route would extend west along the Route 6 ROW and along the edge of Division of Fish and Wildlife lands; while the southern route in the railroad ROW would have the share the ROW with the active rail line for the Cape Cod Dinner Train and would include a connection to the airport parking area and/or inter-modal transportation center in Hyannis depending on final destination selected by Barnstable. This route would need to address any impacts to the Yarmouth Camp Ground which is on the National Register of Historic Places, an on grade crossing of the campground driveway and also a wetland adjacent to the ROW just south of the driveway.

Pathway Connectivity

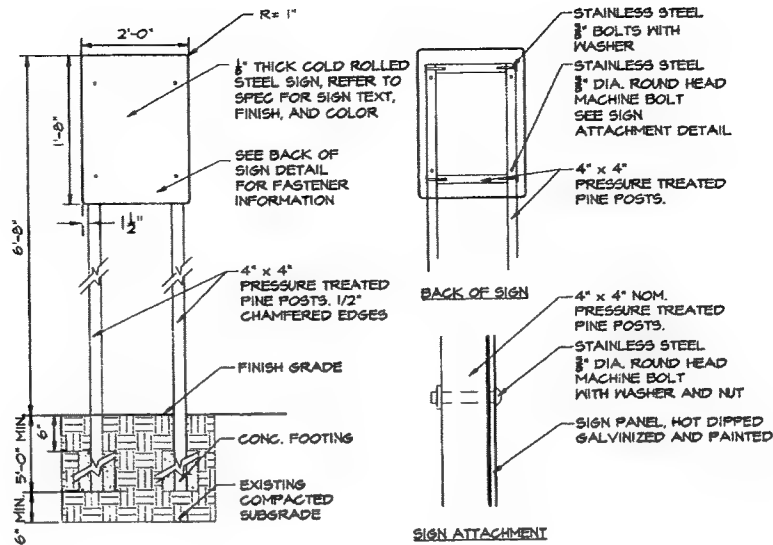
Along the proposed bike route there will be many opportunities for connectivity to other community resources. There are many local businesses and recreation opportunities that may appeal to the CCRT user. Signage should be used to indicate where restrooms, restaurants, and other recreation facilities and resources are located. Some examples would be at the crossing of Main Street in Dennis. A sign indicating the historic District, John Kelly Park and Town Hall would help CCRT users know how to get to these destinations. In the Town of Yarmouth to the east of Station Avenue there is potential connection to several schools as well as Flax Pond Recreation Areas. Strategically located signage will also assist CCRT users know where they are and how to get to the variety of resources along the pathway. A preliminary signage plan is shown on Figure also appended to the end of this section. Signage including site maps at rest stops will be an important aspect of the CCRT extension project the types of signs used, information they give, and style of signs will be further reviewed and developed in the preliminary design phase. Possible signage options utilized by DCR for the CCRT are detailed below. (See Figure 13 for a sample of Wayfinding Signage Plan.)



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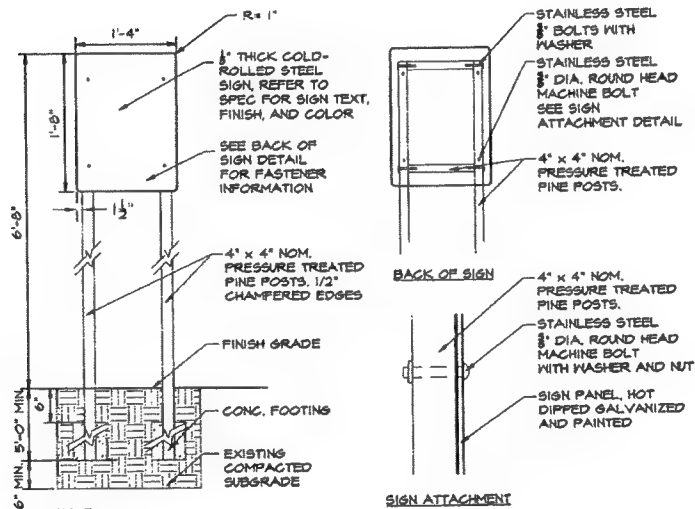
Figure 13
Wayfinding Plan

Cape Cod Rail Trail Extension
Dennis & Yarmouth, Massachusetts



① ROADWAY INTERSECTION SIGN

SCALE: NOT TO SCALE



NOTE:

1. ARROW ON SIGN NEEDS TO CHANGE ACCORDING TO THE INTERSECTION AND THE DIRECTION OF TOWN CENTER FROM THAT INTERSECTION.

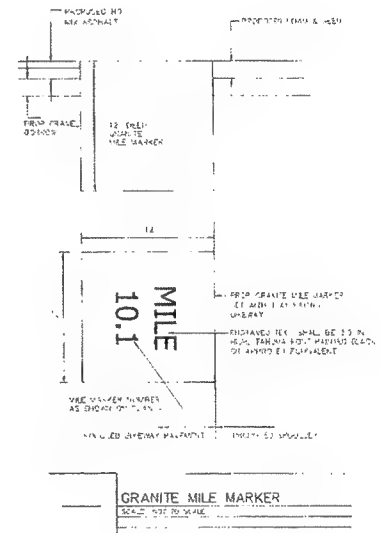
② TOWN DIRECTIONAL SIGN

SCALE: NOT TO SCALE

Site Furnishings

The rail trail should be considered a linear park. As people utilize the CCRT they will need support facilities including benches, signage, waste containers, etc. Along the proposed CCRT extension there are many locations where there are excellent views and rail trail users might wish to stop and rest or take in the views as they travel to their destination or just use the pathway as a recreation resource. There are great views of the Bass River and the Bayberry Hills Golf Course, and potential connections to other resources like Johnny Kelley Park and Flax Pond Recreation Area. Benches made of natural materials such as granite or wood would blend in with the natural surroundings or steel benches with a powder coated finish may also be used. Granite benches like those utilized at the current DCR CCRT would also fit nicely in the natural setting. These benches are much more vandal and weather resistant. Steel benches are also vandal and weather resistant. The cost of these different bench materials varies. While granite may be the more likely choice it may be cost prohibitive, while wood or steel benches would be more economically feasible. This issue would need further review and discussion during preliminary design as well as funding limitations if any by Mass Highway.

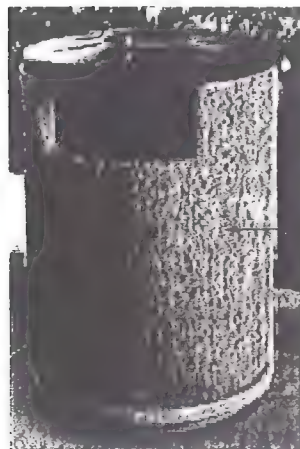
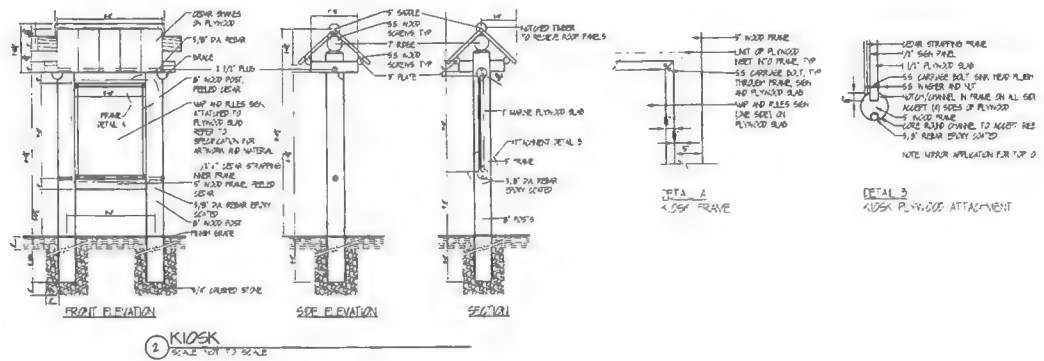
The existing CCRT uses a series of mile markers to let users know how far they have traveled. These markers start at zero in Dennis and go up in mileage towards Wellfleet. The proposed CCRT extension could use a similar design for the mile markers as well as the possibility of flush 1/10 mile markers. It is undesirable to have negative numbers when denoting the mileage of the new extension. One solution would be to denote the mileage in Dennis along the extension with a 'D' before the mileage and a 'Y' indicator in Yarmouth. Using this method a CCRT user could still calculate how far they have traveled and their location for emergency reference. There are different options on what the mile markers could look like. These options include: using the existing mile marker design, using a plaque or granite slab (on the right), or using granite markers that mimic the current design. The proposed design for the mile markers needs further review and discussion during preliminary design.





Throughout the current CCRT route are information kiosks. These kiosks provide the users with information about the local area and resources in close proximity along the trail of importance to the rail trail user. The location along the extension should be in areas where the users are already stopped, such as the major road crossings, parking lots, and rest stops (see Figures X through X). The style

of information kiosks used could be the same as those used on the current CCRT to provide continuity along the trail (see detail below). This issue will need further review and discussion during the preliminary design phase. Along with kiosks, it would be advisable to also have trash receptacles and possibly bike racks. These could be of the same type and design as those used on the current CCRT (see following diagram).



16" DIA. 18" HGT. REINFORCED
CONCRETE
NOTE: REFER TO
SPECIFICATIONS FOR MORE
INFORMATION

① TRASH RECEPTACLE
SCALE: NOT TO SCALE

The proposed CCRT extension route will abut several areas that will require visual screening or access control from the rail trail use. Some of these areas include residential properties, industrial areas, areas of shared use with the active rail line, and possibly areas abutting Route 6. To prevent unwanted accessibility by CCRT



users to abutting properties or uses from abutting commercial businesses fencing is an option. According to MassHighway, they will review the need for fencing on a case by case basis. MassHighway would allow Black PVC coated chain link fencing to limit access to adjacent properties. Where visual screening and or noise attenuation is desired planting will be considered. A mixture of deciduous trees and evergreen trees could be planted in these areas to create this natural buffer. MassHighway will also consider wood fencing in lieu of chain link fencing in the historical districts, if required. This issue will need further review and discussion during the preliminary design phase.

Although the CCRT extension will be a dawn to dusk use recreational area there may be some cases where lighting at street crossings is desirable and the current street lighting levels at on grade crossings will need to be reviewed during preliminary design since potential CCRT users include commuters who may start their day before daybreak. Highway lighting would be advisable at the road crossings.

6

Environmental Issues

Introduction

As described above the proposed CCRT Extension will extend the trail approximately 5.2 miles through Dennis and Yarmouth, Massachusetts (see Figure 1, Project Location Map). The areas through which the trail will be constructed exhibit a variety of land uses and environmental settings. As with most infrastructure projects a number of environmental permits and approvals will be required to construct the bikeway. Below is summary of the conditions along the corridor relative to environmental constraints by town, brief description of anticipate environmental impacts and mitigation, followed by a description of permits/approvals anticipated for the CCRT extension by agency. (See Figures 14 and 15 for the location of environmental resource areas and cultural resource areas.)



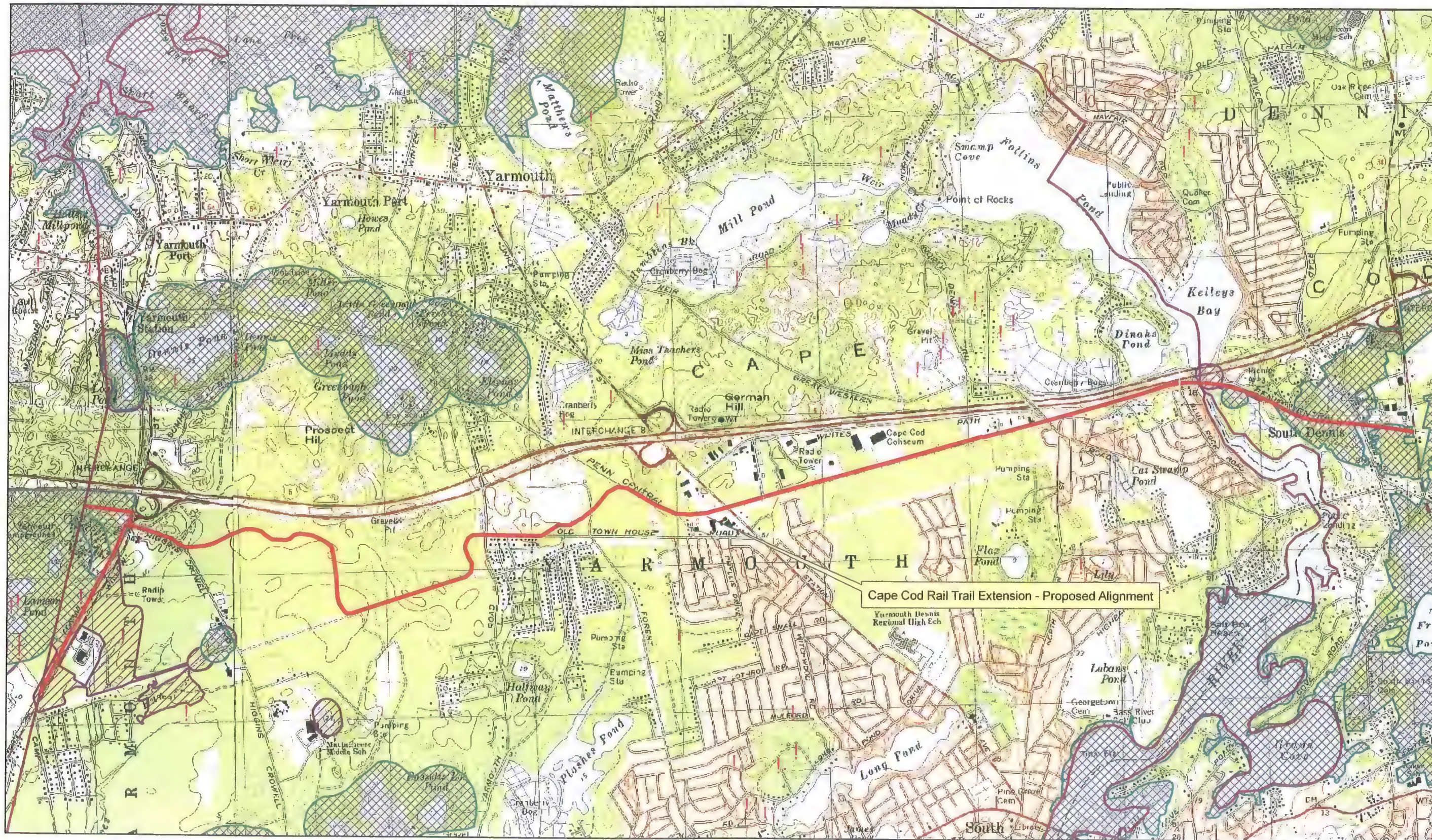
Dennis

Land Use

Within the Town of Dennis, the CCRT Extension the alignment follows the abandoned rail corridor through downtown Dennis and the South Dennis Historic District. The Indian Lands Conservation Area is located south of the corridor generally between Route 134 and the Bass River.

Wetlands and Waterways

The segment of the proposed alignment within Dennis through or adjacent to wetlands or waterways is at the Bass River. One of Cape Cod's most heavily developed waterways; the Bass River is a saltwater river with tidal range of approximately 3 feet. At the railroad crossing, the river is approximately 300 feet wide. The current bridge abutment is in poor condition with some erosion at the toe of slope.



Legend
 Municipal Boundaries

CDM

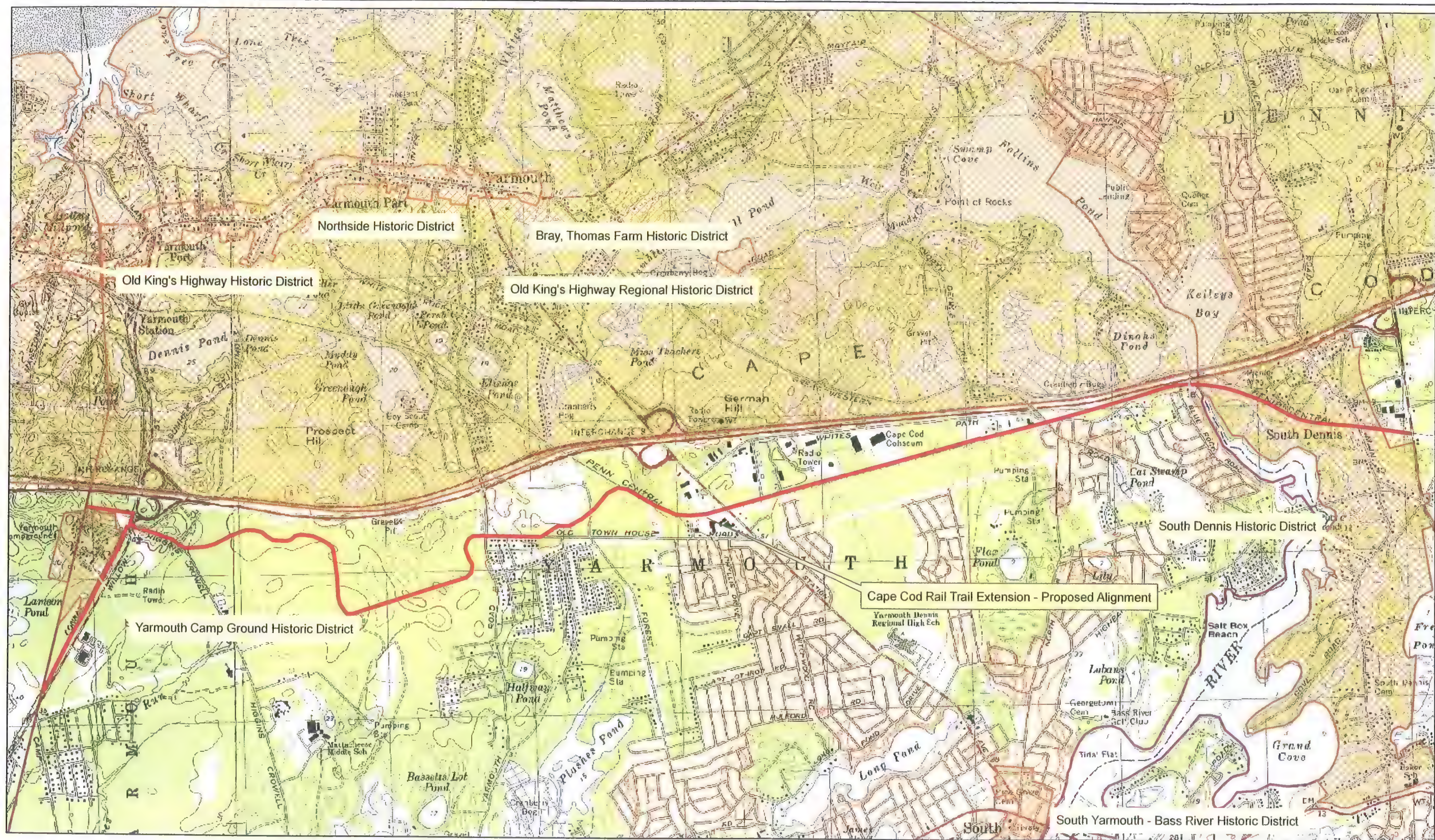


0 500 1,000 2,000 Meters

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Figure 14
 Environmental Resources Map

Cape Cod Rail Trail Extension
 Dennis & Yarmouth, Massachusetts



Legend
 Municipal Boundaries
 Historic Districts

0 490 980 1,960 Meters

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Figure 15
 Cultural Resources Map

Cape Cod Rail Trail Extension
 Dennis & Yarmouth, Massachusetts

CDM





Wetland resource areas expected to be present in the vicinity of the bridge crossing include but are not limited to Coastal Bank, Salt Marsh, Land Under Water, Riverfront Area, Anadromous Fish Runs and Land Subject to Coastal Storm Flowage.

Archeological/Historical

The abandoned rail corridor passes through the South Dennis Historic District, which extends from Route 134 to the Bass River Bridge. There are no historic buildings identified in the Massachusetts State Register of Historic Places on or near the CCRT Extension in Dennis. However, it is likely that there are buildings in the South Dennis Historic District near the right-of-way that are eligible for listing in the Register.

Initial review of the Massachusetts Historical Commission (MHC) records at the Massachusetts Archives revealed no record of any archaeological resources within the project corridor. One archeological site, known as Site 330, was identified in Dennis south of the rail corridor and east of the Bass River. To protect these resources more accurate information of the location or limit of the site is not published. Consultation with the MHC will occur concurrent with other state and federal agencies reviews (e.g. MEPA and the Corps). A more definitive understanding of potential impacts and measures to avoid or mitigate impacts to cultural will develop through MHC consultation.

Estimated/Priority Habitat

The abandoned rail corridor in Dennis bisects Estimated and Priority Habitats, as designated by the Massachusetts Natural Heritage and Endangered Species Program (NHESP). Coordination with NHESP would be necessary to determine which endangered species occupy the habitats in the projects.



Yarmouth

Land Use

The CCRT Extension enters Yarmouth at the municipal boundary at the Bass River. The initial 7/10 mile, from the Bass River to Main Street, of the alignment is located between residential land use to the south and Route 6 to the north. At the Main Street crossing, the trail corridor diverges from Route 6 and turns west-south-west. Here, an industrial area borders the rail corridor to the north, and the Flax Pond Recreation Area and residential areas to the south for approximately 1.55 miles. At the intersection with Station Avenue, the rail corridor passes through a commercial and industrial area. West of this area, the rail corridor becomes an active railroad to the



Yarmouth-Barnstable Solid Waster Transfer Facility. Continuing west the next segment of the CCRT Extension is already constructed, with in the Old Town House Road Park. West of the park boundary, two commercial lots flank the corridor to the south. Past the commercial area, the existing paved path parallels Old Town House Road and then turns to the south, following an existing paved path through the Bayberry Hills Golf Course and then onto a dirt path through woodlands surrounding two Yarmouth drinking water wells. The alignment will then merge onto Higgins Crowell Road to Willow Street.

Wetlands/Waterways

Approximately 1,300 feet west of the Bass River, five isolated wetlands are located adjacent to the rail corridor. Approximately 120 feet east of the Flax Pond Recreation Area, an isolated wetland lies about 130 feet to the south of the rail corridor. Within the Bayberry Hills Golf Course segment, a small isolated wetland abuts the north edge of the trail. Although not within the preferred alignment corridor, southern trail route alternative would require wetland crossings.

Historical/Archeological

Initial review of the Massachusetts Historical Commission records at the Massachusetts Archives revealed no record of any archaeological resources within the project corridor within Yarmouth. There are no identified historical resources in Yarmouth along the trail corridor. Please note that the Yarmouth Camp Ground Historic District in Yarmouth/Barnstable is located approximately 140 feet south of the preferred northern trail alignment. And the southern route to Barnstable will pass along the western property line of the bike path.

Estimated/Priority Habitat

Adjacent to the Yarmouth Camp Ground Historic District, the proposed northern and southern trail alternatives occur within NHESP Estimated and Priority Habitats. Consultation with NHESP will occur concurrently with the MEPA process



Anticipated Environmental Impacts and Mitigation

Bass River Bridge

The bridge abutment is in poor condition and will need to be repaired to ensure long-term stability of the abutments. In addition the span will need to be modified or replaced for use as a multi-use trail. This work would temporarily disturb Coastal Bank, Land Under Water, and Riverfront Area for the repair of the existing bridge abutments. Proper erosion and sediment control measures, such as silt control booms

below mean high water, will be required minimize construction impacts to the river. Time of year restrictions on construction would also minimize impacts to anadromous and other fish species which use the Bass River. It is not anticipated that this repair work would permanently alter any of the identified wetland resource areas.

Please note that a river tidal flushing study is currently in progress by others to evaluate the flow restrictions caused by the Route 6 Bridge and the rail road bridge across the Bass River. That work is a stand alone effort being advanced on its own schedule. The proposed repairs to the existing bridge abutments for re-use as a multi-use trail will not alter the physical conditions of the river cross-section and therefore will not impact the assumptions for, or results of, the flushing study. Nor will the proposed repairs and improvements to the railroad bridge for re-use with the multi-use trail impede any future modifications to the river that may be recommended as a result of the flushing study.

Federal Jurisdictional Wetlands

Six federal jurisdictional wetlands are located within 100 feet of the proposed CCRT Extension alignment, but are not within the footprint of the former railroad bed. Because the existing rail corridor is of sufficient width to support a recreational trail within the former bed cross-section, no permanent alteration of these wetlands is anticipated. Appropriate erosion and sedimentation controls will be implemented during construction to minimize any temporary or indirect alteration to these adjacent wetland resources.

Archeological/Historical Resources

The proposed CCRT Extension alignment is located within the South Dennis Historic District, and the preferred northern alignment in Yarmouth is adjacent to the Yarmouth Historic District. Although the trail will go through the South Dennis district and near the Yarmouth Camp Ground site, impacts to archeological and historic resources are not anticipated. No buildings will be demolished or modified, and it is expected that the project proponents will work with the Historic Commissions of Dennis and Yarmouth, as well as the Massachusetts Historic Commission, to design above ground trail features in accordance with the historic character of the surroundings in these two areas.

No archeological impacts are anticipated within the abandoned rail corridor because work on the proposed CCRT Extension will not occur outside of the existing easement. The project proponents will be coordinating with Massachusetts Historic Commission as part of the overall project environmental review and permitting process.

A goal of the CCRT Extension is to enhance the accessibility to cultural, ecological and recreational resources along the corridor. However, consultation with the South



Dennis Historic Commission and compliance with the pertinent By-Law will be necessary in matters such as fencing and signage.

Estimated/Priority Habitat

The proposed CCRT Extension alignment occurs within Estimated and Priority Habitat at the eastern and western ends of the project area. In Dennis, the abandoned rail corridor crosses Estimated and Priority Habitat east of the Bass River. It is not expected that any permanent impacts, or “takes”, with respect to endangered species would occur in this area. All construction would occur within the existing rail corridor.



Wetland Permits/Environmental Clearances

Federal Approvals/Permits

National Environmental Policy Act (NEPA) Review

The National Environmental Policy Act (NEPA) requires federal agencies to integrate environmental values into their decision-making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. To meet this requirement, federal agencies are required to promulgate NEPA implementation regulations to develop procedures to conduct environmental reviews. Large or complicated projects may be required to an Environmental Assessment (EA) and possibly followed by a detailed review known as an Environmental Impact Statement (EIS). These documents are distributed to federal and state agencies including the U.S. EPA. The U.S. EPA reviews and comments on EAs/EISs prepared by other federal agencies and maintains a national filing system for all NEPA documents. A project may be exempt from NEPA review if it falls meets the criteria for a Categorical Exclusion, as designated by each federal agency.

Categorical exclusions from Federal Highway Administration NEPA review are listed in 23 CFR 771(c). Bicycle paths are addressed in 23 CFR 771(c) (3): “Construction of bicycle and pedestrian lanes, paths, and facilities.” Because the CCRT project meets this criterion, it would be exempt from NEPA review. A Categorical Exclusion checklist review per the MassHighway protocols will be needed to show compliance with this designation to the FHWA.

U.S. Army Corps of Engineers Permit (Section 10 of the Rivers and Harbors Act and/or Section 404 of the Clean Water Act)

Section 10 of the Rivers and Harbors Act of 1899 regulates construction of structures below mean high water in navigable waterways, while Section 404 regulates work, including placement of fill and structures, seaward of the annual high water line, in



navigable waters of the United States. Pursuant to Section 404 of the Clean Water Act, USACE regulates the placement of dredged or fill material in waters of the United States, which extends to the annual high waterline and includes wetlands, where present.

A Corps Permit pursuant to Sections 10 and 404 will be required for any work on the Bass River bridge abutment below annual mean high water. In Massachusetts, the USACE issued a Programmatic General Permit (PGP) allows certain activities to proceed with limited USACE review. Three categories are identified in the PGP - Category I, II, and III. Category I activities are project which result in minor impacts either individually or cumulatively and comply with the published conditions; examples include projects that will alter less than 5,000 square feet of wetlands, or maintenance and repair of permitted structures. Category II activities includes projects that exceed thresholds or do not meet conditions established for Category I activities. Examples include projects that will alter between 5,000 square feet and 1 acre of vegetated wetlands and in stream projects that can not avoid low flow conditions or fish migration season. For Category II activities, the Corps and other federal and state commenting agencies review the application and determine if the project can proceed with conditions or that it must be permitted as a Category III activity. An Individual Permit (Category III) from the Corps is necessary for large projects; one example is projects that fill more than one acre of vegetated wetland. However, the USACE may exercise its discretionary authority and require an Individual Permit even if PGP I and II criteria are met.

It is not anticipated that construction will occur within federal jurisdictional wetlands or waterways; however, repairs to the Bass River bridge abutments will require work within a federal jurisdictional. It is expected that the project will meet either Category I or II criteria of the PGP, because the work is expected to be limited to repairs to an existing structure.

Historical/Archaeological Preservation Review & Compliance Section 106 of the National Historic Preservation Act

Any project that requires funding, licensing, or permits from federal agencies must be reviewed for compliance with Section 106 of the National Historic Preservation Act of 1966 as amended (16I/S/C 470), and implemented by the federal Advisory Council on Historic Preservation's procedures, Protection of Historic Properties (36 CFR Part 800). Compliance with Section 106 requires consultation with the State Historic Preservation Officer (SHPO) to determine if significant cultural resources are in or eligible for listing in the National Register of Historic Places within or near the project area. In Massachusetts the MHC is the state agency that functions as the SHPO.

The Section 106 review process follows a series of steps by which federal agencies identify and evaluate historic and archaeological resources that may be affected by a project, assess adverse effects to cultural resources, if any, and take prudent and feasible measures to avoid, minimize or mitigate impacts.



Consultation with the Advisory Council on Historic Preservation (ACHP) and the Tribal Historic Preservation Officer (THPO) also occurs if significant cultural resources may be adversely affected.

Information regarding implementation, duration and overall project compliance with Section 106 of the National Historic Preservation Act is provided below under the state review process – M.G.L. Chapter 9, Sections 26-27c, as amended by Chapter 254 of the Acts of 1988 (950 CMR 71.00), dealing with protection of historic and archaeological resources and unmarked burials.

EPA National Pollutant Discharge Elimination System (NPDES) Construction General Permit

EPA regulates storm water discharges from construction sites as an industrial discharge through the Construction General Permit (CGP) for projects that disturb 1 acre or more. Compliance with the CGP includes preparing a Stormwater Pollution Prevention Plan (SWPPP) and submitting a Notice of Intent to Discharge (NOI), to EPA. This CGP includes construction dewatering activities for discharges to wetlands and surface water bodies.

Construction of a paved recreational trail will involve approximately 13 acres of construction area, exceeding the 1 acre threshold for the NPDES Construction General Permit. The SWPPP presents Best Management Practices (structural and methods) that the contractor will follow to prevent transport of pollution from the project site via storm water runoff. To comply with the CGP, the contractor must follow the SWPPP as written and keep it available on the project site at all times.

State Approvals/Permits

Massachusetts Environmental Policy Act

The Massachusetts Environmental Policy Act (MEPA) requires the environmental review of certain projects requiring state agency action. Agency actions include granting state permits or licenses, providing state financial assistance, or transferring state land. The MEPA Regulations (301 CMR 11.00) establish thresholds, a procedure, and timeline for a two-tiered review process, which generally proceeds as follows: the project proponent submits an Environmental Notification Form (ENF) to the Secretary of Environmental Affairs (Secretary). A public comment period follows during which time the Secretary receives comments from the public and regulatory agencies, and holds a site visit and consultation session. At the close of the comment period, the Secretary issues a certificate on the ENF stating whether an Environmental Impact Report (EIR) is needed and what the EIR should include, if required; or that no further MEPA review is required.

Based on review of the preliminary layout, it appears that the project will exceed the ENF review threshold of creating at least 5 acres of impervious surface [301 CMR 11.03(1) (b) (2)], assuming a trail width of 10 feet. An ENF will need to be filed with MEPA before any other state permits are granted. This project does not meet or exceed any mandatory EIR thresholds, therefore it is not anticipated that an EIR will be required. However, it is within the Secretary's discretionary authority to require an EIR based on public comment or project impacts.

Massachusetts Endangered Species Act Review

The Massachusetts Endangered Species Act (MESA) requires that any projects occurring within Estimated Habitat or Priority Habitat be reviewed for potential impacts, or "takes" to endangered species. MESA is administered by the Massachusetts Natural Heritage and Endangered Species Program (NHESP).

Projects occurring within Estimated Habitat and Priority Habitat must undergo a MESA review. If NHESP determines that the project will result in a "take" of endangered species as designed, it is usually possible to redesign the project to avoid impacts to endangered species. If avoiding a "take" is not possible, a Conservation and Management Permit must be obtained to move forward with the project.

It is not expected that the CCRT extension project would result in a "take", because the areas of work within Estimated Habitat and Priority Habitat occur within or adjacent to existing railroad or roadway Rights of Way. In any case, coordination with NHESP should occur as soon as possible in the design process to avoid project delays.

Section 401 Water Quality Certification

Pursuant to Section 401 of the Clean Water Act, federal permits for projects in wetlands or waterways must be certified by the Massachusetts Department of Environmental Protection (MassDEP) that state water quality standards are met. If the project will alter less than 5,000 square feet of wetlands and no dredging is proposed, no Section 401 application is required as long as the applicant obtains an Order of Conditions for the work. If the project will involve dredging of 100 cubic yards to 5,000 cubic yards of sediment, a Minor Project Certification will be required. Major Project certification is required if, among other criteria, more than 5,000 square feet of wetlands will be altered or more than 5,000 cubic yards of sediment will be dredged. Note, a Certificate from the MEPA is required, if MEPA thresholds are met or exceeded, before an individual certification can be issued.

It is not expected this project will involve any permanent alteration of wetlands. Repair of the Bass River Bridge abutment may involve some dredging, but it is not anticipated to exceed a volume of 100 cubic yards. The limit of state and federal jurisdictional wetland areas within 100 feet of all of the proposed construction work will need to be delineated. Note that this delineation would occur simultaneously with that conducted for the USACE application and Notices of Intent per the WPA.

Chapter 91 Waterways License

Chapter 91, the Massachusetts Public Waterfront Act and its Regulations 310 CMR 9.00, is administered by the MassDEP Waterways Regulation Program. The waterways licensing program was established in 1866 and dates back to the Colonial Ordinances of 1641-1647, which granted to the public rights in tidelands and great ponds. The oldest state waterways regulatory program in the country, Chapter 91 regulates activities on both coastal and inland waterways, including construction, dredging and filling in tidelands, great ponds and certain rivers and streams.

The purpose of Ch. 91 is to protect the public's proprietary rights as well as exercise certain regulatory control in tidelands, great ponds and non-tidal rivers and streams of the Commonwealth of Massachusetts. Areas subject to Chapter 91 jurisdiction include navigable waterways below the annual mean high water, filled tidelands, and flowed tidelands below the annual mean high water.

Five basic types of activities are subject to Chapter 91 authorization. These include both new and existing unauthorized activities associated with structures, filling, dredging, change in use, structural alteration, and demolition/removal of structures. The placement or construction of structures below mean high water is subject to Chapter 91 authorization. A change in use of a licensed site also requires a Chapter 91 license.

The proposed rail trail project will require repairing the Bass River bridge abutments and rebuilding or retrofitting the bridge span over the Bass River. There are two existing Chapter 91 licenses for construction and maintenance of this bridge see Appendix B for copies of the Licenses... If the proposed bridge abutment work is considered routine repair or maintenance to the previously licensed structure, no new license should be required. A new Chapter 91 license would be required for a change in use of a previously licensed structure. If MassDEP determines that converting the railroad bridge to a recreational trail bridge constitutes a change in use, a Chapter 91 license would be required for the work. If Chapter 91 jurisdiction for the proposed work is in question, a Chapter 91 Request for Determination of Applicability should be submitted to MassDEP. MassDEP will in turn provide written notification as to whether a Chapter 91 License authorization is required.

A Chapter 91 license application should describe the project, including type, purpose, and location, information about other applicable state permits, a certification that the project does not violate municipal zoning, and notification of the municipal planning board. Projects are subject to a 30-day public comment period advertised in a newspaper of general circulation. A copy of the Notice of Intent filed with the local Conservation Commission under the Wetlands Protection Act must also be included with the Chapter 91 application.

Historic Preservation Act, Massachusetts Historical Commission (MHC) Section 106 and Chapter 254 Compliance

The Massachusetts Historical Commission (MHC) is the state agency which functions as the SHPO in Massachusetts and identifies, evaluates, and protects the state's significant cultural resources pursuant to Section 106 of the National Historic Preservation Act. Any new construction projects or renovations to existing buildings that require state funds, licenses, or permits are subject to the review requirements of the M.G.L. Chapter 9, Sections 26-27c, as amended by Chapter 254 of the Acts of 1988 (950 CMR 71.00), and MEPA. The state regulations set up a review process that mirrors the federal "Section 106" regulations to identify historic properties, assess effect, and consult interested parties to avoid, minimize, or mitigate any adverse effects. Compliance with Section 106 and/or M.G.L Chapter 9 is also generally required as part of the NEPA, USACE, and MEPA permitting review process.

The proposed trail alignment passes through the South Dennis Historic District and in the vicinity of the Yarmouth Camp Ground Historic District in Yarmouth/Barnstable. As such, consultation with the MHC will be required to determine whether potentially sensitive archaeological/historical features could be affected by construction to convert the abandoned rail road grade to a multi-use trail. Please see discussion above for potential presence of archaeological resources within or in the immediate vicinity of the proposed CCRT extension corridor.

A Project Notification Form (PNF) is prepared and submitted to initiate MHC review and should be submitted during the preliminary planning stage. The PNF should include: a detailed narrative description of the proposed project; a description of the existing conditions and the nature of any past development of disturbances on the project site, if any; a list of all the federal and state funds, licenses, and permits required for the entire project; photographs of existing areas to be disturbed; and a USGS project location map and proposed site plan.

The MHC generally provides a written response within 30 days regarding whether: 1) there are known or anticipated historic or archaeological properties within the project area, 2) the project is likely to affect cultural resources, 3) additional information is needed to assess the likelihood that cultural properties will be affected by the proposed project, 4) an archaeological survey (i.e., Reconnaissance and Intensive Surveys, Site Examination, and Data Recovery) or historic study of the property is warranted, and 5) what, if any, avoidance or mitigation measures may be appropriate. If the MHC determines that the project is unlikely to affect significant historic or archaeological resources, the MHC review is complete.

Note that the MHC may require an archaeological investigation(s) for this project since some construction will occur within undisturbed areas between Old Town House Road and Willow Street in Yarmouth. Construction will also occur east of the Bass River and along the northern boundary of the Indian Lands Conservation Area. If MHC review is required, site investigation by a qualified archaeologist would be



needed and the scope of investigation must be approved by MHC before field work may occur. Since archaeological investigations can add significant cost and time delays to a proposed project, consultation with the MHC is advised early during the planning process.

Regional and Local Approvals/Permits

The MassHighway is the project proponent of the CCRT Extension Project. MassHighway is not obligated to obtain local permits. During the project design phase it is recommended to review the design elements with local boards and agencies, including but not limited to Planning Boards, Zoning Boards of Appeals, Conservation Commissions, for their input and consistency with local standards. Although not a requirement, MassHighway attempts to design its projects in accordance with local regulations to the extent practicable. Therefore, the following is provided for informational purposes.

Cape Cod Commission

The Cape Cod Commission is a regional land use planning and regulatory agency created by an Act of the Massachusetts General Court in 1990. Through its Regulatory Program, the Commission reviews projects that present regional issues identified in the Act, including water quality, traffic flow, historic values, affordable housing, open space, natural resources, and economic development.

The Commission's regulatory powers are well defined and generally limited to reviews of large-scale developments, known as "Developments of Regional Impact" (DRIs), throughout Cape Cod (all 15 towns of Barnstable County). The Commission's authority supplements local authority. Towns refer projects to the Commission for DRI review as: 1) mandatory referrals, which are required for any project exceeding specific thresholds; and 2) discretionary referrals, which towns use at their option to seek Commission consideration of specific project-related impacts. At the option of applicants, joint state/regional reviews are conducted for projects going through the Massachusetts Environmental Policy Act (MEPA) process.

DRI Thresholds are listed at Chapter A of the Enabling Regulations Governing Review of Developments of Regional Impact (Barnstable County Ordinance 90-12) Section 3 (a) through (k). Although it appears that the CCRT Extension Project could be interpreted to meet or exceed two DRI thresholds, i.e.:

- (b) The construction or expansion of any bridge, ramp, road or vehicular way that crosses or provides direct access to an inland pond, barrier beach, coastal bank, dune, beach or tidal wetland or waterbody (as defined by MGL Ch. 131, Section 40) except a bridge, ramp or driveway serving no more than three single-family dwelling(s), or*



- (j) *Site alterations or site disturbance greater than two acres including but not limited to clear cutting, grading, and clearing land, ...*

The project is not expected to require review as a DRI, based on past experience and precedents set by other bike trails on Cape Cod.

Order of Conditions per the Wetlands Protection Act – Local Conservation Commission(s)/MassDEP

In accordance with the Massachusetts Wetlands Protection Act, authorization is required from the municipal Conservation Commission for any work in and adjacent to protected wetland resource areas. An Order of Conditions (wetland permit) is required for any work within a protected wetland resource area (including but not limited to Bordering Vegetated Wetland, Inland Bank, 200-foot Riverfront Area and/or the 100-year flood plain, Coastal Bank, Salt Marsh, Coastal Beach) or when the Conservation Commission determines that an Order of Conditions will be required for work in the 100-foot Buffer Zone area.

Additionally, MassDEP recently revised the NOI Form relative to Endangered Species Act review. When work is proposed in Estimated Habitat of Wetland Wildlife and/or Priority Habitat of plants and/or upland species, the NOI form essentially serves as a "joint application" to both the Conservation Commission and MassDEP per the Wetlands Protection Act, and the Natural Heritage and Endangered Species Program (for inland species) or the Department of Marine Fisheries [DMF] (for coastal species) per the Mass. Endangered Species Act [MESA].

It is anticipated that trail improvements work will take place within the 100-foot Buffer Zone to Coastal Bank or Salt Marsh associated with the Bass River, while repairs to the bridge abutments, defined as Coastal Bank, will be within a resource area. There is mapped Estimated Habitat in Dennis east of the bass River, therefore an Order of Conditions will be required from the Dennis Conservation Commission and the project will re NHESP review.

The NOI(s) for the project will include a detailed description of the project, describe wetland resource area impacts, alternatives, mitigation measures, and design drawings. At the public hearing, the applicant typically presents the project to the Commission(s), answers questions and discusses potential construction conditions. The Commission may require a project site walk or additional data. The project may be continued for subsequent hearing(s) if the final determination is not made at the first hearing.

For streamlined NOI/MESA review, site photos, an assessor's map, and filing fee also need to be included along with a copy of the NOI to the NHESP. If the project will alter more than 10 acres of land, a vegetation cover type map of the site and project plans showing boundaries of Priority and Estimated Habitat must be



submitted as well. It is not expected that this project will alter more than 10 acres of land area.

Dennis Wetland Protection By-Law

The Dennis Conservation Commission, in addition to administering the Massachusetts Wetlands Protection Act, promulgated a local bylaw and regulations, much of which are based on the state wetlands law and regulations, with some exceptions. For example, all “freshwater wetlands,” including isolated wetlands, are protected by the Dennis Bylaw. The Dennis Wetland By-Laws are included in Appendix C.

Yarmouth Wetland Protection By-Law

The Yarmouth Conservation Commission has a local bylaw and regulations, similar to the Dennis Wetland By-Laws. For example, all “vegetated wetlands,” including isolated wetlands are protected by the Yarmouth Bylaw. Additionally, the 100-foot wetlands Buffer Zone is considered a “resource area” by the Yarmouth Wetlands Bylaw. The Yarmouth Wetland By-Law is included in Appendix C.

Local Historic District Review

Any project occurring within a Historic District must be reviewed by the local Historic Commission for compliance with historic guidelines. External features, such as signs, fences, and the rail trail itself, must comply with historic standards within historic districts. When the Historic District approves of the proposed work, it issues a Certificate of Appropriateness, allowing the work to go forward. This process must be completed for both the South Dennis Historic District and the Yarmouth Camp Ground Historic District. The South Dennis Historic District By-Law and the Yarmouth Historic Properties By-Law are attached in Appendix D.

Permit Strategy

Issuance of many of the permits described above is dependent on prior approval of one or more other permits or authorizations. For this reason, the best approach is to obtain the permits in a specific sequence to streamline the process and avoid delays. Issuance of federal, state, and local permits required for this project could take twelve to twenty four months. Please see Table 1 for a preliminary permitting schedule. The MEPA review process must be completed before state permits are issued to ensure that all state agencies have sufficient information to review the project and make a permitting decision. Thus, the permitting plan includes initiating MEPA review with the 25% design plans. Preparation of the NEPA categorical Exclusion review is also completed early in the design process.

After the MEPA process is complete, applications will be prepared for the Yarmouth and Dennis Orders of Conditions, followed by MESA review, 401 Water Quality

Table 1				
MassHighway Department - Cape Cod Rail Trail Extension Permitting Schedule				
Design	25% Phase	50% Phase	75% Phase	100% Phase
Permits/Approvals				
MEPA/NEPA Categorical Exclusion				
U.S. Army Corps of Engineers Permit				
MESA Review				
401 Water Quality Certification				
National Historic Preservation Act/ MA Historical Commission				
Orders of Conditions				
Chapter 91 Waterways				
Local Approvals (as applicable)				



Certification, and the U.S. Army Corps of Engineers PGP approval. The U.S. Army Corps of Engineers requires that the 401 Water Quality Certification be obtained before the ACOE permit is effective, but review of the two permit applications can occur simultaneously. These permits applications will be developed during the 50% to 75% design phase and will be sought with the 75% design plans.

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Public Building Consensus Program

The proposed CCRT extension route abuts residential neighborhoods and some commercial/industrial areas and will serve as a linear park providing connectivity to numerous community facilities and resources. A thorough public outreach program was conducted to share ideas and solicit input for all of the groups to ensure that the proposed facilities would be fashioned to serve the greatest number of users. The details of this program as well as the issues and concerns that were identified are presented below as well as other sections of this report: Public participation was encouraged by both the Town of Dennis and the Town of Yarmouth. Each meeting was advertised through the local paper, The Cape Cod Times, through postings in the Dennis and Yarmouth Town Halls, and through mailed fliers to prior meeting attendees. A Citizens Advisory Committee (CAC) was formed in Yarmouth to help advocate for abutting residents and potential rail trail users. In Dennis the Traffic and Transportation Committee was utilized as the public forum due to the fact that the bikeway currently exists in majority and the proposed extension is limiter to 0.9 miles all of which will be within the existing Railroad ROW. The Yarmouth and Dennis Committees served as the sounding board and were invited to participate in all public meetings to maximize their input during the feasibility study. The public meetings were held to inform the public of the project and anticipated route, identify and address issues of concern, and solicit support by residents and potential user groups. At each meeting a sign in sheet was available where each attendee could sign up to receive communication for the next scheduled meeting. A schedule of all the meetings may be found in Appendix X. In addition to the public meetings, a site meeting was conducted with the board from the Yarmouth Campground. This group was concerned with the close proximity of the CCRT extension to their property and limit of Railroad ROW. This group of landowners represented by members of their board and also on the advisory committee had issues with where the pathway was located and potential for public trespassing on to the campground property which appears public, including their playground and field area. They requested the CCRT be separated from their property with a fence and also screened to the extent possible. Similar issues were raised with the Beacon Street neighborhood. In this case it was agreed that where possible the pathway would be aligned away from the

neighborhood along the northern edge of the Railroad ROW as grades permit. Once the alignment is refined in preliminary design, a site meeting would be conducted with the Beacon Street neighborhood to determine if fencing and or screening is desirable along the edge of the ROW. Participation from other entities was also solicited including bike and equestrian groups. There were also meetings with MassHighway to review alignment and project approach as well as discuss issues raised by abutters and MassHighway standards since they will oversee the project bidding and construction. A meeting and site walk was also conducted with the Department of Conservation and Recreation to discuss any issues that they may have with the proposed alignment and connection to the existing CCRT and the interface of the pathways. There were also presentations with the Town of Yarmouth and Dennis Selectman to educate them on preliminary Feasibility Study findings, identify issues, discuss next steps, receive their input and solicit support of the towns for moving the project forward thru preliminary design. Copies of meeting minutes of all meetings and samples of presentation boards and handouts are included in the Appendix of this report.

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Conceptual Project Cost Estimate

The following chart shows an approximation of project values and estimate of costs for the CCRT Extension through the towns of Yarmouth and Dennis:

Project Costs

Item	Quantity	Units	Unit Cost	Cost
Full-depth Pavement	29,450	SY	\$33.00	\$971,850
Overlay (Existing Bituminous Pavement)	8,300	SY	\$12.00	\$99,600
Widening (Bayberry)	400	SY	\$24.00	\$9,600
Seeding	29,450	SY	\$6.50	\$191,425
Clearing & Grubbing	59,000	SY	\$4.50	\$265,500
Screening – Vegetation	2,000	LY	\$125.00	\$250,000
Screening – Fence	925	LY	\$150.00	\$138,750
Parking	28,130	SY	\$23.50	\$646,990
Rest Area	10	EA	\$20,000.00	\$170,000
Granite Mile Markers	8	EA	\$500.00	\$4,000
1/10th Mile Markers	75	EA	\$100.00	\$7,500
Silt Fence & Hay Bales	50	LY	\$45.00	\$2,250
Railroad Fencing	1000	LF	\$20.00	\$20,000
Bridge: Bass River	1	LS	\$286,000.00	\$286,000
Bridge: Station Avenue	1	LS	\$911,000.00	\$911,000
<u>Bridge: Route 134</u>	<u>1</u>	<u>LS</u>	<u>\$965,000.00</u>	<u>\$965,000</u>
				\$4,939,465
Contingency (20%)				\$990,000
Design (Civil)				\$250,000
Design (Structural)				\$260,000
Miscellaneous Services (Permits/Geotechnical/Landscaping)				\$175,000
Police Services				\$200,000
Traffic Management				<u>\$150,000</u>
			Total	<u>6,961,465</u>



The cost estimate outlined above was developed from large scale concept plans and based upon cost information available. Costs are subject to change as a result of changes in the economy and scope of improvement. (See Appendix A for preliminary cost calculations.)

9

Feasibility Study Conclusions

The 5.2-mile extension of the CCRT is an exciting opportunity to extend the current rail trail from Route 134 in the Town of Dennis (at the terminus of the current DCR rail trail) through Yarmouth to the Barnstable town line. It offers the potential to expand a significant regional resource as well as linear park connecting numerous other community facilities and resources in the towns and region. The proposed project requires the cooperation and common vision and planning of multiple communities to make this project a reality. The proposed 5.2-mile project has a special benefit of for the most part being able to be constructed on the abandoned rail line or previously constructed pathways which eliminates the need for costly acquisition and potential for time delays. As proposed it will traverse the communities of Dennis and Yarmouth, abutting many residential, commercial and industrial properties as well as town-owned lands, providing a unique ribbon of green space...

The extension of the CCRT through a primarily residential community requires acceptance from a variety of stakeholders, and the purpose of this study was to solicit public input, document existing conditions, identify potential pathway alignment, document issues and costs and outline permits and approvals that will be required to insure project implementation as the project moves forward into design. The Feasibility Study has confirmed the pathway extension is feasible and documented the supported by the public, local and state officials. The study has also established a foundation on the work with stakeholders to identify the physical, environmental, and sociological issues and constraints and possible mitigation measures that will be important for final acceptance of the CCRT extension as the project moves thru design, permitting and construction.

During the extensive public participation process the stakeholders, including MassHighway officials, town residents and civic leaders, project abutters, the Department of Conservation and Recreation, and representatives of the respective police departments have agreed in principal that extending the CCRT on publicly owned and/or controlled lands through each town was an acceptable, safe, beneficial



and appropriate use of public resources. These stakeholders did, however, identify the following recommendations that will need to be considered as the design proceeds:

- Recognize the proposed facility as a linear park within the communities that could potentially connect numerous community resources.
- At high-volume intersections where grade separation is required, construct railroad-type through-truss structures memorializing the history of the railroad through the communities.
- In certain neighborhoods where security and/or privacy is desired, use a combination of special alignment, vegetative barriers, and selective use of fencing to minimize visual and noise impacts and provide separation of the trail users from private properties.
- MassHighway representatives require consistency with standard planning and design practices as outline in the current edition of the Massachusetts Highway Design Guidelines and the Manual on Uniform Traffic Control Devices.
- Promote facility connectivity to other resources within the towns through the use of public awareness programs and prudent use of informational and 'way-finding' signs.
- Minimize impacts to the character of historically significant neighborhoods, address security and safety issues with pathway design and also identify publicly accessible restrooms along the proposed route.
- Ensure flexibility in the design of the geometry at the westerly terminus at the Barnstable town line to allow for connections to both the Clair Saltonstall bike route on Route 132 and the Transportation Center on Main Street in Hyannis.

In conclusion we would like to thank all the citizens, general public, and state and public officials who have participated and provided important input in the public process of this feasibility. With out their efforts and input the project would not have reached this first important milestone and garnered the level of public support demonstrated. We look forward to working further with all interested parties as the project progresses through design, permitting and construction to take this project from concept to reality.

Appendix 1

Preliminary Cost Estimates



Vanasse Hangen Brustlin, Inc.

101 Walnut Street
P. O. Box 9151
Watertown, MA 02471-9151
617 924 1770
FAX 617 924 2286

Memorandum

To: George Allaire; Director
Yarmouth DPW
Joseph Rodricks, Town Engineer
Dennis, DPW

Date: August 28, 2007

Project No.: 09794.00

From: Joseph D. Magni Jr, PE

Re: CCRT Extension - Conceptual Cost
Estimate

The following chart shows approximation of project values and estimate of costs for the CCRT Extension through the towns of Yarmouth and Dennis

Project Costs

ITEM	QUANTITY	UNITS	UNIT COST	COST
Full Depth Pavement	29,450	SY	\$33.00	\$971,850
Overlay (Exist. BP)	8,300	SY	\$12.00	\$99,600
Widening(Bayberry)	400	SY	\$24.00	\$9,600
Seeding	29,450	SY	\$6.50	\$ 191,425
Clearing & Grubbing	59,000	SY	\$4.50	\$265,500
Screening – Vegetation	2000	LY	\$125.00	\$ 250,000
Screening – Fence	925	LY	\$150.00	\$138,750
Parking	28,130	SY	\$23.00	\$646,990
Rest Area	10	EA	\$17,000.00	\$170,000
Granite Mile Markers	8	EA	\$500.00	\$4,000
1/10th Mile Markers	75	EA	\$100.00	\$7,500
Silt Fence & Hay Bales	50	LY	\$45.00	\$2,250

Bridge: Route 134	1	LS	\$965,000	\$965,000
Bridge: Bass River	1	LS	\$286,000	\$286,000
Bridge: Station Ave	1	LS	\$911,000	\$911,000
Bridge: Willow Street	(Not included)	LS	NA	\$0.0
Railroad fencing	1000	LF	\$20	\$20,000

	Sub-total	\$4,936,465
Contingency (20%)		\$990,000
Design (Civil)		\$250,000
Design Structural		\$260,000
Landscaping		\$75,000
Environmental		\$50,000
Geotechnical		\$50,000
Traffic Mgmt		\$150,000
Police Services		\$200,000
	Total	<u>\$6,961,465</u>
	SAY	\$6,970,000



Computations

Project:

Project #

Location:

Sheet of

Calculated by:

Date:

Checked by:

Date:

Title

ROUTE 134 COST BREAKDOWN

Route 134 - Cost Summary

Alternative	Cost
A: Steel Girder Bridge	\$1,007,000
B: Precast Concrete Box Girder Bridge	\$978,000
C: Prefabricated Steel Truss Bridge	\$965,000
D: Prefabricated Timber Truss Bridge	\$981,000
E: Precast Concrete Tunnel	\$1,073,000
F: Steel Invert Tunnel	\$978,000



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Through Girder Estimate - Route 134		

Through Girder Preliminary Design

Geometry

Span (ft) = 100
Width (ft) = 16

Live Load Girder:

Loading = HS15
 M_{H20} (k-ft) = 1143 (AASHTO 17th Ed., pg 693)
 V_{H20} (k) = 49.00
 I = 1.3 (Impact)
 M_{H20} (k-ft) = 743
 V_{H20} (k) = 32
 w_{ped} (psf) = 85 (Pedestrian live load)
 M_{ped} (k-ft) = 850
 V_{ped} (k) = 34

Floorbeam:

Floor beam spacing (ft) = 5
No. of floor beams = 20
 P_{wheel} (kip) = 12
 M_{ll} (k-ft) = 60.0

(Moment = $P \cdot a$, where a is the distance from the curb to the wheel, see AISC beam tables for simply support beam with two point loads equi-distant from end)

Dead Load Girder:

Assume a W40x268

w_{girder} (plf) = 268
 M_{girder} (k-ft) = 335
 $M_{fbongirder}$ (k-ft) = 68 (Moment from the floor beams on the girder assuming the load is uniformly distributed on girder)
 t_{slab} (in) = 8
 $w_{slabongirder}$ (plf) = 800
 $M_{slabongirder}$ (k-ft) = 1000 (Moment from the slab on the girder assuming the load is uniformly distributed on girder)
 $w_{railing}$ (plf) = 75
 $M_{railingongirder}$ (k-ft) = 93.8

Floorbeam:

Assume a W10x49

$w_{floorbeam}$ (plf) = 49
 M_{fb} (k-ft) = 1.57
 $M_{slabonfb}$ (k-ft) = 16.00 (Moment from the slab on the floor beam)

Dead Load + Live Load + Impact Girder:

$M_{totgirder}$ (k-ft) = 2346.4

Floor Beam:

$M_{totfloorbeam}$ (k-ft) = 17.57

Allowable Bending Stress:

Girder: the girder has an unbraced top flange, therefore reduce the bending stress per AASHTO Table 10.32.1A

$$F_b = (50 \times 10^6 \cdot C_b / S_{xc}) \cdot (I_{yc} / l) \cdot (0.772 \cdot (J / I_{yc}) + 9.87 \cdot (d / l)^2)^{0.5} \leq 0.55 F_y$$

Assume a W40x297

w_{girder} (plf) = 297
 S_{xc} (in³) = 1170
 t_w (in) = 0.93
 t_f (in) = 1.65
 b_f (in) = 15.825
 d (in) = 39.84
 I_{yc} (in⁴) = 544.92
 l (in) = 300 (assume top flange to be braced at 1/4 points)
 J (in⁸) = 58.07
 C_b = 1.75 (pinned at both ends)



Vanasse Hangen Brustlin, Inc.

Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Through Girder Estimate - Route 134		

F_b (ksi) = 27.50

Check Bending:

f_b (ksi) = 24.07
Check = OK

Floor Beam:

Assume a W10x49

$W_{floorbeam}$ (plf) = 49

F_b (ksi) = 27.5

S_x (in³) = 54.6

f_b (ksi) = 13.19

Check = OK

Cost Estimate:

Steel Cost (\$/lb) = \$2.00 (Based on 2005 MHD Bridge Manual 20 of 24 and increased for inflation and current prices)

Girder: lbs = 59400

Floor Beam: lbs = 15680

Misc Steel: lbs = 15016

(Assume an additional 20% for steel to account for connections and preliminary nature of calc)

Σ = 90096

\$180,192

Concrete Cost (\$/yd) = \$700.00 (Based on 2005 MHD Bridge Manual 21 of 24 and increased for inflation and current prices)

Cubic Yards = 40 (Deck concrete only)

Cost = \$27,654

Reinf. Steel Cost (\$/lb) = \$1.50 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

lbs = 7901 (Assume 200lbs per cubic yard)

Cost = \$11,852

Railing Cost (\$/ft) = \$150.00 (Based on 2005 MHD Bridge Manual costs)

LF Railing = 200

Cost = \$30,000

HDPE Railing Cost (\$/ft) = \$35.00 (Based on Shining Sea Bikepath costs)

LF Railing = 1520 (Based on 380ft approach ramps on both sides of bridge)

Cost = \$53,200

Gravel Borrow (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

CY = 15510 (Based on 380ft approach ramps on both sides of bridge)

Cost = \$310,200

New Abutments (\$) = \$156,000 (See hand calcs)

Traffic Management (\$) = \$50,000

Mob Demob (\$) = \$20,000

Subtotal = \$839,098

Contingency = 20.0%

Total = \$1,006,918

Say = \$1,007,000



Computations

Project: CCRT

Location: Yarmouth, MA

Calculated by: RUP

Checked by:

Title

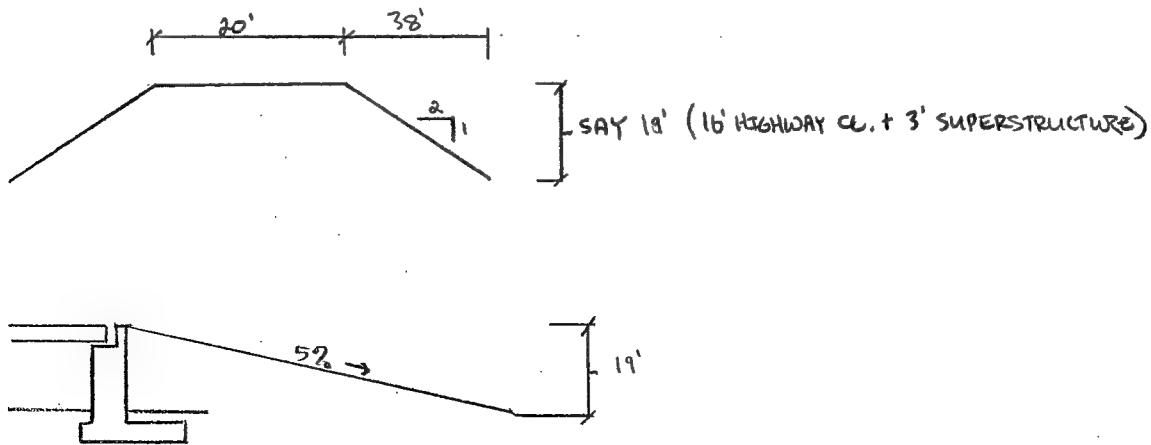
Project # 07974

Sheet of

Date: 5/1/07

Date:

APPROACH RAMPs -



$$\text{LENGTH OF RAMP REQ'D} = 19' / (0.05) = \underline{\underline{380 \text{ FT}}}$$

$$\text{AREA @ BRIDGE} = 20' \times 19' + 2 \left(\frac{38' \times 19'}{2} \right) = \underline{\underline{1102 \text{ SF}}}$$

$$\text{AREA @ END OF RAMP} = 0'$$

$$\text{VOLUME} = 1102 \text{ SF} \times \frac{380 \text{ FT}}{2} \times \frac{1}{27} = 7755 \text{ CY} \times 2 \text{ APPROACHES}$$

$$\boxed{= 15510 \text{ CY}}$$

HDPE RAILING -

$$380' \text{ RAMP} \times 2 \text{ SIDES} \times 2 \text{ APPROACHES} = \boxed{1520 \text{ LF}}$$



Computations

Project: CCRT

Location: Yarmouth, MA

Calculated by: RWP

Checked by:

Title

Project # 09794

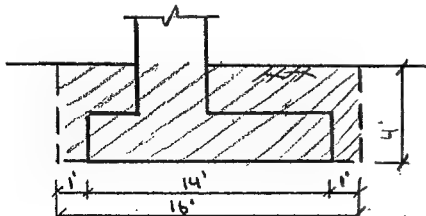
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Date: 5/1/07

Date:

ABUTMENT COSTS -

BRIDGE EXCAVATION -



$$\text{VOLUME} = 16' \times 22' \times 4' \times \frac{1}{27} \times 2 = \underline{\underline{1105 \text{ CY}}}$$

$$\text{FROM MHD BRIDGE MANUAL} = \$20/\text{CY}$$

$$\text{TOTAL} = 105 \text{ CY} \times \$20/\text{CY} = \boxed{\$2100}$$

GRAVEL BORROW -

$$7' \text{ WIDE} \times 20' \text{ HIGH} \times 20' \text{ LONG} \times \frac{1}{27} \times 2 = \underline{\underline{208 \text{ CY}}}$$

$$\text{FROM MHD BRIDGE MANUAL} = \$25/\text{CY}$$

$$\text{TOTAL} = 208 \text{ CY} \times \$25/\text{CY} = \boxed{\$5200}$$

BITUMINOUS DAMPPROOFING -

$$20' \text{ WIDE} \times 20' \text{ LONG} \times \frac{1}{9} \times 2 = 89 \text{ SY}$$

$$\text{FROM MHD BRIDGE MANUAL} = \$11/\text{SY}$$

$$\text{TOTAL} = 89 \times 11 = \boxed{\$1000}$$



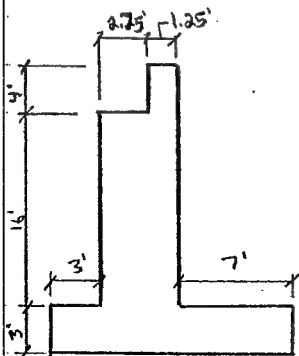
Computations

Project: CCRT
 Location: Yarmouth, MA
 Calculated by: RWP
 Checked by:
 Title

Project # 09794
 Sheet of
 Date: 5/1/07
 Date:

ABUTMENT COSTS -

CLASS A. CONCRETE - (SAY 20' WIDE ABUTMENTS)



$$\begin{aligned} \text{FIG. } 14' \times 3' \times 20' \text{ LONG} &\times \frac{1}{27} \times 2 = 63 \text{ CY} \\ \text{STEM. } 4' \times 16' \times 20' &\times \frac{1}{27} \times 2 = 95 \text{ CY} \\ \text{BEKWALL. } 4' \times 1.25' \times 20' &\times \frac{1}{27} \times 2 = 8 \text{ CY} \end{aligned}$$

$$\text{TOTAL} = \underline{\underline{166 \text{ CY}}}$$

$$\text{FROM MHD BRIDGE MANUAL} = \$600/\text{CY}$$

$$\text{TOTAL} = \$600 \times 166$$

$$= \$100,000$$

STEEL REINFORCEMENT -

$$\text{SAY } 150 \#/\text{CY} \quad 150 \#/\text{CY} \times 166 \text{ CY} = \underline{\underline{24900 \#}}$$

$$\text{FROM MHD BRIDGE MANUAL} \rightarrow \text{REBAR} = \$1.50/\#$$

$$\text{TOTAL} = \$1.50/\# \times 24900 \#$$

$$= \$37350$$

BEARING PADS -

$$\text{SAY } \$10000 \quad (\text{BASIC ASSUMPTION})$$

$$= \$10000$$

GRAND TOTAL -

$$2100 + 5200 + 1000 + 100000 + 37350 + 10000 = \$156000.00$$



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Precast Conc. Beam Estimate - Route 134		

Precast Concrete Beam - Preliminary Design Geometry

Span (ft) = 100
Width (ft) = 16

Cost Estimate:

Precast Beam Cost (\$/lb) = \$400.00 (Based on 2005 MHD Bridge Manual 14 of 24 and increased for inflation and current prices)

LF Beam = 400 (Assumes 4 beams will be needed)

Cost = \$160,000

Concrete Cost (\$/yd) = \$700.00 (Based on 2005 MHD Bridge Manual 21 of 24 and increased for inflation and current prices)

Cubic Yards = 8

Cost = \$5,833

Reinf. Steel Cost (\$/lb) = \$1.50 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

lbs = 1250 (Assume 150lbs per cubic yard)

Cost = \$1,875

Membrane WP (\$/SY) = \$125.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

Area (SY) = 178

Cost = \$22,222

Binder Course (\$/Ton) = \$200.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)

Tons = 15

Cost = \$3,000

Pavement (\$/Ton) = \$150.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)

Tons = 15

Cost = \$2,250

Railing Cost (\$/ft) = \$150.00 (Based on 2005 MHD Bridge Manual costs)

LF Railing = 200

Cost = \$30,000

HDPE Railing Cost (\$/ft) = \$35.00 (Based on Shining Sea Bikepath costs)

LF Railing = 1520 (Based on 380ft approach ramps on both sides of bridge)

Cost = \$53,200

Gravel Borrow (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

CY = 15510 (Based on 380ft approach ramps on both sides of bridge)

Cost = \$310,200

New Abutments (\$) = \$156,000 (See hand calcs)

Traffic Management (\$) = \$50,000

Mob Demob (\$) = \$20,000

Subtotal = \$814,581

Contingency = 20.0%

Total = \$977,497

Say = \$978,000



Vanasse Hangen Brustlin, Inc.

Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Prefab Steel Truss Estimate - Route 134		

Prefab Steel Truss - Preliminary Design

Geometry

Span (ft) = 100

Width (ft) = 16

Cost Estimate:

Prefab Truss Cost (\$/LF) = \$1,300.00 (Based on information from Contech Bridge)

LF = 100 (Designed and delivered to site)

\$130,000

Truss Install Cost (\$/SF) = \$40.00 (Based on information from Contech Bridge)

SF = 1600 (Designed and delivered to site)

\$64,000

Railing Cost (\$/ft) = \$150.00 (Based on 2005 MHD Bridge Manual costs)

LF Railing = 200

Cost = \$30,000

HDPE Railing Cost (\$/ft) = \$35.00 (Based on Shining Sea Bikepath costs)

LF Railing = 1520 (Based on 380ft approach ramps on both sides of bridge)

Cost = \$53,200

Gravel Borrow (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

CY = 15510 (Based on 380ft approach ramps on both sides of bridge)

Cost = \$310,200

New Abutments (\$) = \$156,000 (See hand calcs)

Traffic Management (\$) = \$50,000

Mob Demob (\$) = \$10,000 (Only 50% of other superstructure options, truss install costs are accounted for elsewhere)

Subtotal = \$803,400

Contingency = 20.0%

Total = \$964,080

Say = **\$965,000**



4021 Gault Avenue South
Fort Payne, AL 35967
(256) 845-0154
(800) 749-7515
Fax: (256) 845-9750
www.steadfastbridge.com

DATE: August 22, 2006
TO: VHB
ATTN: PETER CHIU
PHONE: 401-272-8100
FAX: 401-273-9694
RE: CAPE COD BIKE PATH BRIDGE

We are pleased to quote you a price on the Continental Bridge described below. The floor will be a 22 gage galvanized composite floor deck. Reinforcing steel and pouring of the lightweight concrete shall be by the owner or contractor. This bridge will be fabricated from A588 Weathering Steel. This will provide a "maintenance free" bridge. All Continental Bridges carry a 10 year limited warranty. Shop drawings signed and sealed by a Professional Engineer registered in the State of Massachusetts will be provided.

Location: YARMOUTH, MA

Bridge Type:	Connector
Width in feet	14'-0"
Span in feet	80'-0"
Type steel	A588 WX
Type floor	CONCRETE
Floor thickness	5"
Field splice	YES
Number of pieces	4
Dead Load PSF	70
Live Load PSF	85
Vehicle Load LBS.	20,000
Design stresses	AASHTO
Lifting Weight LBS.	39368.4
Vert. abutment load KIPS	86.8
Horiz. abutment load KIPS	7.7
Truss height in feet	5.5
Interior panel points	12
Toe plates	NO
Railing height	54"
Maximum rail openings	4"

SAY \$90,000/80 LF
= \$1125/LF

FOR 14' WIDE TRUSS

\$1125/LF x (16/14)
= \$1286/LF

SAY \$1300/LF

ERECT, MOBIL ETC
5%

Bridge cost delivered

\$ 88,025.00 x 1.05 = \$92,426.25

Delivery: 12 to 14 weeks (delivery schedule subject to backlog at time of drawing approval).
Bridge will be delivered to nearest location easily accessible to over-the-road trucks.
Tefflon slip pads and setting plates shipped with bridge.
Anchor bolts, sales tax, unloading, erection, supports, and abutment designs not included.
Terms: 1/3 down, balance 20 days after delivery, pending credit approval.
This quote is valid for 90 days. Please call if you have any questions (800-749-7515).

Scott Dempsey
Estimator

Accepted By: _____
Title / Date: _____





Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Prefab Timber Truss Estimate - Route 134		

Prefab Timber Truss - Preliminary Design

Geometry

Span (ft)= 100
Width (ft)= 16 (Curb to curb)

Cost Estimate:

Prefab Truss Cost (\$/SF)= \$90.00 (Based on information from Western Wood Structures)
SF = 1600 (Designed and delivered to site)
Cost = \$144,000

Truss Install Cost (\$/SF)= \$40.00 (Based on information from Contech Bridge)
SF = 1600 (Designed and delivered to site)
Cost = \$64,000

Railing Cost (\$/ft) = \$150.00 (Based on 2005 MHD Bridge Manual costs)
LF Railing = 200
Cost = \$30,000

HDPE Railing Cost (\$/ft) = \$35.00 (Based on Shining Sea Bikepath costs)
LF Railing = 1520 (Based on 380ft approach ramps on both sides of bridge)
Cost = \$53,200

Gravel Borrow (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 15510 (Based on 380ft approach ramps on both sides of bridge)
Cost = \$310,200

New Abutments (\$) = \$156,000 (See hand calcs)

Traffic Management (\$) = \$50,000

Mob Demob (\$) = \$10,000 (Only 50% of other superstructure options, truss install costs are accounted for elsewhere)

Subtotal = \$817,400
Contingency= 20.0%
Total = \$980,880

Say = \$981,000

Collins, Andrew

From: Hazen Hyland [hazenh@westernwoodstructures.com]

Sent: Tuesday, September 12, 2006 12:15 PM

To: Collins, Andrew

Subject: RE:

Andy,

Yes, we offer bowstring truss bridges in spans less than 100'. 65' is an adequate length for a bowstring truss bridge. On a 100' pony truss or bowstring truss bridge, figure installation of 8-10 days with 4 bodies. I'm just shooting from the hip, as it could go faster depending on the crew. Basically you build the bridge on the ground, then make one pick with a crane.

Wood vs. Steel...obviously the natural look of wood usually fits well in any surrounding environment. All our products are customer, as in we can make your bridge length precisely what you need. If you want a unique looking rail, we can work with you to attain this. If anything happens to your bridge in the first year, we will fix it. Our 1 year warranty is offered because any bridge problem will usually occur in the first year.

Installation costs: Approximately 40-\$45 per square foot, and this doesn't include the crane cost. I'd have to first research what crane costs run in your neck of the woods.

IF WESTERNWOOD STRUCT. INSTALLS IT (PREMIUM)

Good questions,

FOR WESTFIELD BIKE PATH CALCULATED ^{\$}53/sf

Hazen Hyland
Western Wood Structures, Inc. - est. 1969
20675 SW 105th Ave
PO Box 130
Tualatin, OR 97062
www.westernwoodstructures.com

(800) 547 - 5411 phone
(503) 692 - 6434 fax

-----Original Message-----

From: Collins, Andrew [mailto:ACollins@VHB.com]

Sent: Tuesday, September 12, 2006 8:36 AM

To: Hazen Hyland

Subject: RE:

This is a huge help, thanks a ton.

Do you have the bow string option for spans less than 100'? Also, about how long does it take the contractor to assemble the truss and about how many workers does it require? If its not too much trouble would you send me your estimate for installation?

The timber option seems to be competitive with the steel truss option. If you can offer any additional talking points as to why timber is advantageous over steel I'd appreciate it.

Thanks very much,
Andy

9/12/2006

From: Hazen Hyland [mailto:hazenh@westernwoodstructures.com]

Sent: Tuesday, September 12, 2006 11:17 AM

To: Collins, Andrew

Subject:

Andy,

I've included some details of previous projects in the attachments above.

Budgetary per square foot prices for a pony truss Timber Bridge.

14' x 65' - \$86 to \$88 } FOR ESTIMATING SAY \$90/SF · \$90 × 14' = \$1260
 14' x 100' - \$84 to \$86 }

If you need an abutment design (I realize you're trying to reuse the existing abutments), this is something we offer. Cost for abutment design (regardless of bridge length): \$1,700.

Above prices include design, supply, and delivery of all bridge materials. Because materials are predrilled and precut, the bridge is ready for installation upon arrival.

Another option, and I'm just throwing it out there, is a bowstring truss bridge. There's more height to this bridge, something you maybe trying to avoid, but the arch makes the bridge somewhat distinguishable). The PSF cost of a bowstring truss bridge 100' long is the same price as a pony truss bridge.

Since you've been on our website, you've probably already filtered out the bridge types you are not interested in. However if you are interested in seeing photos of a bowstring truss bridge, click on the "Teufel Nursery Bridge" picture on our home page (it's one of the rotating pictures).

If you need budgetary installation figures, we can provide them.

Thank you Andy,

Hazen Hyland
 Western Wood Structures, Inc. - est. 1969
 20675 SW 105th Ave
 PO Box 130
 Tualatin, OR 97062
www.westernwoodstructures.com

(800) 547 - 5411 phone
 (503) 692 - 6434 fax

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 Vanasse Hangen Brustlin, Inc. 101 Walnut St
 Watertown, MA 02472
 617-924-1770

9/12/2006

Collins, Andrew

From: Hazen Hyland [hazenh@westernwoodstructures.com]
Sent: Tuesday, September 12, 2006 11:17 AM
To: Collins, Andrew
Attachments: pony truss bridge.pdf; bowstring truss bridge.pdf

Andy,

I've included some details of previous projects in the attachments above.

Budgetary per square foot prices for a pony truss Timber Bridge.

14' x 65' - \$86 to \$88

14' x 100' - \$84 to \$86

If you need an abutment design (I realize you're trying to reuse the existing abutments), this is something we offer. Cost for abutment design (regardless of bridge length): \$1,700.

Above prices include design, supply, and delivery of all bridge materials. Because materials are predrilled and precut, the bridge is ready for installation upon arrival.

Another option, and I'm just throwing it out there, is a bowstring truss bridge. There's more height to this bridge, something you maybe trying to avoid, but the arch makes the bridge somewhat distinguishable). The PSF cost of a bowstring truss bridge 100' long is the same price as a pony truss bridge.

Since you've been on our website, you've probably already filtered out the bridge types you are not interested in. However if you are interested in seeing photos of a bowstring truss bridge, click on the "Teufel Nursery Bridge" [picture](#) on our home page (it's one of the rotating pictures).

If you need budgetary installation figures, we can provide them.

Thank you Andy,

Hazen Hyland
Western Wood Structures, Inc. - est. 1969
20675 SW 105th Ave
PO Box 130
Tualatin, OR 97062
www.westernwoodstructures.com

(800) 547-5411 phone
(503) 692-6434 fax

9/12/2006

Transportation
Land Development
Environmental
Services



Vanasse Hangen Brustlin, Inc.

101 Walnut Street

Post Office Box 9151

Watertown

Massachusetts 02471-9151

617.924.1770

FAX 617.924.2286

Phone
Notes

Person Contacted:

Title:

Company: *Western Wood*

Telephone No.:

FAX No.:

VHB Rep:

Andy Collins

VHB Project No.:

09794

Project Name:

Type of Call:

Date and Time:

10,000 lb Vehicle

14 x 65

14 x 100

}

*He will provide estimate for both spans
and both truss and girder*

Truss Style

or

Girder Style

}

*For 65' They can do both truss
and girder*

*life span → 50 years conservatively, but most likely
longer, 60-70 years*



Vanasse Hangen Brustlin, Inc.

Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Precast Tunnel Estimate - Route 134		

Precast Concrete Tunnel - Preliminary Design Geometry

Span (ft) = 100
Width (ft) = 16 (outside width)
Height (ft) = 15 (outside height)
Embedment (ft) = 2 (from roadway to top of culvert)

Cost Estimate:

Box Culvert Cost (\$/LF) = \$1,620.00 (See hand calc)
LF Tunnel = 100
Cost = \$162,000

Culvert Installation (\$/Day) = \$10,000.00
Days = 6.67 (Assume 15ft per day)
Cost = \$66,667

Bridge Excavation (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 1200 (Assumes 1ft pay limit from all structures)
Cost = \$24,000

Unclassified Excav. (\$) = \$12.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 6970 (See hand calc)
Cost = \$83,640

Gravel Borrow (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 230 (Assume 1ft pay limit on all sides)
Cost = \$4,593

Bit. Dampproofing (\$/SY) = \$10.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
SY = 335
Cost = \$3,351

Bridge Railing (\$/LF) = \$150.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
LF = 152 (Equals width of culvert plus both wingwalls)
Cost = \$22,800

Binder Course (\$/Ton) = \$200.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)
Tons = 190 (Assumes new pavement length equals the culvert width plus both wingwall lengths)
Cost = \$38,000

Pavement (\$/Ton) = \$150.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)
Tons = 95 (Assumes new pavement length equals the culvert width plus both wingwall lengths)
Cost = \$14,250

Temp Shoring (\$/SY) = \$350.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
SY = 98 (Assumes tunnel will be constructed in two sections)
Cost = \$34,378

Lighting (\$) = \$32,500 (See hand calcs)

Drainage (\$) = \$16,250 (See hand calcs)

Wingwalls (\$) = \$235,730 (See hand calcs)

Traffic Management (\$) = \$100,000

Mob Demob (\$) = \$20,000

Subtotal = \$858,158
Contingency = 25.0%
Total = \$1,072,698

Say = \$1,073,000



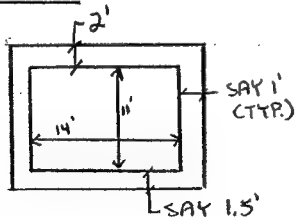
Computations

Project: CCRT
Location: Yarmouth, MA
Calculated by: MWP
Checked by:
Title

Project # 09794
Sheet of
Date: 5/1/07
Date:

PRECAST CONCRETE BOX GIRDER-

CONCRETE:



$$\text{ROOF: } 2' \times 14' = 28 \text{ SF}$$

$$\text{WALLS: } 1' \times (11' + 2') \times 2 = 26 \text{ SF}$$

$$\text{BASE: } 1.5' \times 14' = 21 \text{ SF}$$

$$\text{TOTAL} = \underline{\underline{75 \text{ SF/FT}}}$$

$$= 2.78 \text{ CY/FT SAY } \underline{\underline{3 \text{ CY}}}$$

REBAR:

$$\text{SAY } 200\text{\#}/\text{CY} \quad 75/27 = 2.78 \text{ CY} \times 200\text{\#}/\text{CY} = \underline{\underline{560\text{\#}/\text{FT}}}$$

COSTS: (PER MHD)

(NOTES: CONCRETE AND REBAR COSTS ARE LESS BECAUSE INSTALLATION COSTS ARE ACCOUNTED FOR ELSEWHERE.)

$$\text{CONCRETE: } 3 \text{ CY @ } \$400/\text{CY} = \$1200/\text{LF}$$

$$\text{REBAR: } 560\text{\#}/\text{FT @ } \$0.75/\text{\#} = \underline{\underline{420/\text{LF}}}$$

TOTAL

$$= \boxed{\$1620/\text{LF}}$$



Computations

Project: CERT

Location: Yarmouth, MA

Calculated by: RUP

Checked by:

Title

Project # 09794

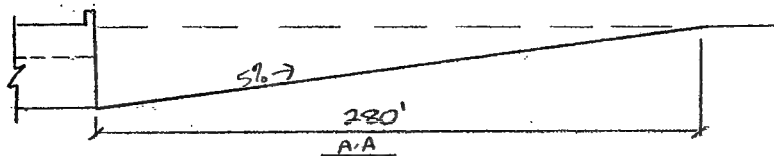
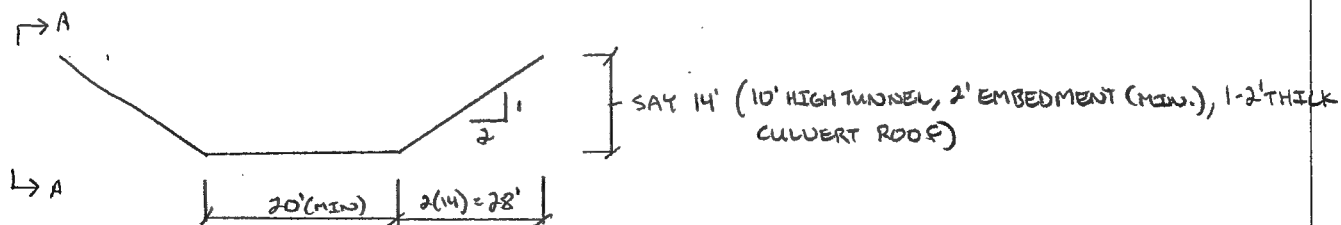
Sheet of

Date: 5/1/07

Date:

UNCLASSIFIED EXCAVATION-

APPROACHES- (ASSUME 5% SLOPE REQUIRED)



$$14' / 0.05 = 280 \text{ LONG.}$$

$$\text{AREA @ CULVERT} \rightarrow 20' \times 14' + 28' \times 14' = 672 \text{ SF}$$

$$\text{AREA @ TOP OF RAMP} \rightarrow = 0 \text{ SF}$$

$$\begin{aligned} \text{TOTAL VOLUME} &= 672 \text{ SF} \times 280' \times \frac{1}{2} \times \frac{1}{27} \\ &= 3485 \text{ CY} \\ &\times 2 \text{ SIDES} \end{aligned}$$

$$\text{TOTAL} = \boxed{6970 \text{ CY}}$$

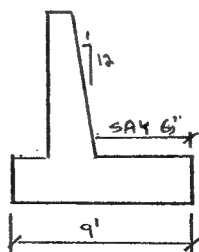
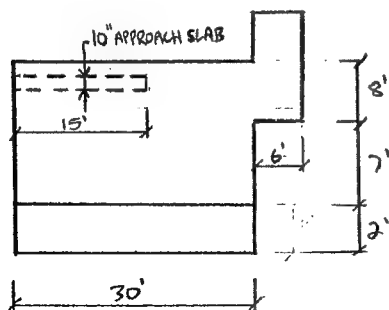


Computations

Project: CCRT
 Location: Yarmouth, MA
 Calculated by: RUP
 Checked by:
 Title

Project # 09794
 Sheet of
 Date: 5/1/07
 Date:

CULVERT WINGWALLS -



STEM: $1.0' \times 15' \times 30'$
 $((\frac{1}{2} \times 15) \times 15') \times 0.5 \times 30'$
 FTG: $2' \times 9' \times 30'$
 FLY. WW: $8' \times 6' \times 1.0'$
 END POST: $5' \times 3.5' \times 1.0'$

= 450 CF
 = 282
 = 540
 = 48
 = 18

= 1338 CF x 4 WW = 5352 CF

APPROACH SLAB: $60' \times 15' \times 10''$ = 750 CF x 2

= 1500 CF

TOTAL = $(5352 + 1500) / 27$

= 254 CY

FROM MHD BRIDGE MANUAL \rightarrow \$600/CY = 254×600

= \$152400

WINGWALL REBAR -

ASSUME 150 #/CY \rightarrow $254 \text{ CY} \times 150 \text{ \#/CY}$

= 38100 #

FROM MHD \rightarrow \$1.50/#

TOTAL = 38100×1.5

= \$57150



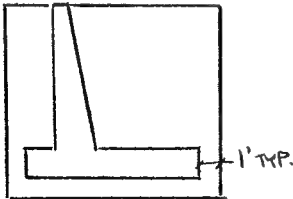
Computations

Project: CCRT
Location: Yarmouth, MA
Calculated by: RWP
Checked by:
Title

Project # 09994
Sheet of
Date: 5/1/07
Date:

WINGWALLS - CONT -

BRIDGE EXCAVATION:



$$11' \times 16' \times 31' \times 4 \times \frac{1}{27} = \underline{809 \text{ CY}}$$

$$\text{TOTAL} = 809 \text{ CY} \times \$20/\text{CY}$$

$$= \$16180$$

GRAVEL BORROW:

$$6' \times 15' \text{ HIGH} \times 30' \text{ LONG} \times 4 \text{ WINGWALLS} \times \frac{1}{27} = \underline{400 \text{ CY}}$$

$$\text{TOTAL} = 400 \text{ CY} \times \$20/\text{CY}$$

$$= \$8000$$

B.T. DAMPPROOFING-

$$15' \text{ HIGH} \times 30' \text{ LONG} \times 4 \times \frac{1}{9} = \underline{200 \text{ SY}}$$

$$\text{TOTAL} = 200 \text{ SY} \times \$10/\text{SY}$$

$$= \$2000$$

GRAND TOTAL-

$$\$152400 + 57150 + 16180 + 8000 + 2000$$

$$= \$235730$$



Vanasse Hangen Brustlin, Inc.

Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Steel Invert Tunnel Estimate - Route 134		

Steel Invert Tunnel - Preliminary Design

Geometry

Span (ft) = 100
Width (ft) = 16 (outside width)
Height (ft) = 15 (outside height)
Embedment (ft) = 2 (from roadway to top of culvert)

Cost Estimate:

Steel Invert Cost (\$/LF) = \$600.00 (From Contech)
LF Tunnel = 100
Cost = \$60,000

Culvert Installation (\$/Day) = \$10,000.00
Days = 6.67 (Assume 15ft per day)
Cost = \$66,667

Bridge Excavation (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 1200 (Assumes 1ft pay limit from all structures)
Cost = \$24,000

Unclassified Excav. (\$) = \$12.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 6970 (See hand calc)
Cost = \$83,640

Gravel Borrow (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 590 (Assume 1ft pay limit on all sides)
Cost = \$11,793

Concrete (\$/CY) = \$600.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 34 (See hand calc)
Cost = \$20,400

Rebar (\$/LB) = \$1.50 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
LB = 5100 (See hand calc)
Cost = \$7,650

Bit. Dampproofing (\$/SY) = \$10.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
SY = 335
Cost = \$3,351

Bridge Railing (\$/LF) = \$150.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
LF = 152 (Equals width of culvert plus both wingwalls)
Cost = \$22,800

Binder Course (\$/Ton) = \$200.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)
Tons = 190 (Assumes new pavement length equals the culvert width plus both wingwall lengths)
Cost = \$38,000

Pavement (\$/Ton) = \$150.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)
Tons = 95 (Assumes new pavement length equals the culvert width plus both wingwall lengths)
Cost = \$14,250

Temp Shoring (\$/SY) = \$350.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
SY = 98 (Assumes tunnel will be constructed in two sections)
Cost = \$34,378

Lighting (\$) = \$26,000 (See hand calcs)

Drainage (\$) = \$13,000 (See hand calcs)

Wingwalls (\$) = \$235,730 (See hand calcs)

Traffic Management (\$) = \$100,000

Mob Demob (\$) = \$20,000

Subtotal = \$781,658
Contingency = 25.0%
Total = \$977,073

Say = \$978,000



Computations

Project: CCRT
Location: Yarmouth, MA
Calculated by: PWP
Checked by:
Title

Project # 09794
Sheet of
Date: 5/1/07
Date:

CONCRETE FOR INVERT TUNNEL-

$$\begin{array}{llll} \text{CURB} & (0.75' \times 2' \times 2 \text{ SIDES}) \times \frac{1}{27} & = 0.12 \text{ CY/LF} & \} \underline{0.22 \text{ CY/LF}} \\ \text{INU. LINER} & (2\frac{1}{2}' \times 15') \times \frac{1}{27} & = 0.10 \text{ CY/LF} & \\ \text{COLLAR} & 1.5' \text{ THICK} \times [(15.5' \times 2.5') + (\frac{1}{2} \times 8' \times 8' \times 2)] \times \frac{1}{27} & = \underline{12.0 \text{ CY/LF}} & \end{array}$$

$$\text{REBAR} - 150 \#/\text{CY} \rightarrow 12 \text{ CY} \times 150 = \underline{1800 \#} + 33 \#/\text{LF}$$

GRAVEL BORROW-

$$\text{ABOVE THE ARCH} - [(15.5' \times 2') + (\frac{1}{2} \times 8' \times 8' \times 2)] \times \frac{1}{27} = \underline{3.6 \text{ CY/LF}}$$



Computations

Project:

Project #

Location:

Sheet of

Calculated by:

Date:

Checked by:

Date:

Title

BASS RIVER COST BREAKDOWN

Bass River - Cost Summary

Alternative	Cost
A: Rehabilitate Existing Structure	\$260,000
B: Steel Girder Bridge	\$252,000
C: Precast Concrete Box Girder Bridge	\$255,000
D: Prefabricated Steel Truss Bridge	\$275,000
E: Prefabricated Timber Truss Bridge	\$286,000



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Rehab. Exist. Estimate - Bass River		

Rehabilitate Existing Superstructure - Preliminary Design

Geometry:

Span (ft) = 65
Width (ft) = 16 (Curb to curb)

Cost Estimate:

Steel Repair Cost (\$/lb) = \$3.00
lbs = 12500
Cost = \$37,500

Concrete Cost (\$/yd) = \$700.00 (Based on 2005 MHD Bridge Manual 21 of 24 and increased for inflation and current prices)
Cubic Yards = 26
Cost = \$17,975

Reinf. Steel Cost (\$/lb) = \$1.50 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
lbs = 5136 (Assume 200lbs per cubic yard for deck concrete)
Cost = \$7,704

Railing Cost (\$/ft) = \$150.00 (Based on 2005 MHD Bridge Manual costs)
LF Railing = 130
Cost = \$19,500

Clean, Paint, Etc. (\$) = \$75,000 (See hand calcs)

Abut. Rehab (\$) = \$30,000 (See hand calcs)

Mob. / Demob. (\$) = \$20,000

Subtotal = \$207,679.0
Contingency = 25.0% (25% to account for unknown condition of beams, environmental issues, etc.)
Total = \$259,599

Say = \$260,000



Computations

Project: CCRT
Location: Yarmouth, MA
Calculated by: RWP
Checked by:
Title

Project # 09794
Sheet of
Date: 5/1/07
Date:

EXIST. GIRDER GEOMETRY-

REPAIR-

$$\left[6' \text{ DEEP} \times 65' \text{ LONG} \times \left(0.75 \frac{\text{web}}{12} \right) \right] \times \left[\left(14 \frac{1}{2} \right) / 144 \times 65' \times 2 \text{ FLANGES} \right] \times 490 \frac{\text{#}}{\text{ft}^3} = 15050 \frac{\text{#}}{\text{ft}^3}$$

x 2 BEAMS
25% FLOOR BEAMS + 7500 #

$$\text{TOTAL} = \underline{\underline{37600 \frac{\text{#}}{\text{ft}^3}}}$$

$$37600 \frac{\text{#}}{\text{ft}^3} \times 1.25 \quad \downarrow \text{MISC. STIFFENERS, ETC.} = 47000 \frac{\text{#}}{\text{ft}^3} \rightarrow \text{SAY } \underline{\underline{50000 \frac{\text{#}}{\text{ft}^3}}}$$

ASSUME 25% NEEDS REPLACEMENT:

$$50000 \frac{\text{#}}{\text{ft}^3} \times 0.25 = \boxed{12500 \frac{\text{#}}{\text{ft}^3}}$$

CLEAN / PAINT, DE LEAD-

$$A_{\text{STEEL}} = \left[(6' \times 2 + 14 \frac{1}{2} \times 4) \times 2 \times 65' \right] \times 1.30 \quad \downarrow \text{MISC, FLOOR BEAMS ETC.} = 2820 \text{ SF}$$

$$\text{SAY } \underline{\underline{3000 \text{ SF}}}$$

$$\$25/\text{SF} \leftarrow \text{AULSON CO. (SEE ATTACHED)} \times 3000 \text{ SF}$$

$$= \boxed{\$75000}$$

REHAB ABUT. / WINGWALLS-

$$\text{SAY } \boxed{\$30,000} \text{ FOR REPAIR, REPOINTING, TYP.}$$



Vanasse Hangen Brustlin, Inc.

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Watertown

Massachusetts 02471-9151

617.924.1770

FAX 617.924.2286

**Phone
Notes**

Person Contacted: Chris Pocoli

Title: _____

Company: The Aulson Company

Telephone No.: 800-998-0212

FAX No.: Methuen, MA

VHB Rep: Andy Collins

VHB Project No.: 06846

Project Name: Columbra greenway Bikepath

Type of Call: Painting lost

Date and Time: 2/2/05

Called Chris to find out about painting and de-leading cost. He
said for simple structures:

\$20 /sf

more complex or structures over water, RR, low clearance:

\$25 /sf

TO BE CONSERVATIVE WE CAN USE \$25/sf



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Through Girder Estimate - Bass River		

Through Girder - Preliminary Design

Geometry:

Span (ft)= 65
Width (ft)= 16 (Curb to curb)

Live Load Girder:

Loading= HS15
 m_{H20} (k-ft)= 685.5 (AASHTO 17th Ed., pg 693)
 v_{H20} (k)= 46.40
 I = 1.3 (Impact)
 M_{H20} (k-ft)= 446 (Truck moment per beam)
 V_{H20} (k)= 30 (Truck shear per beam)
 w_{ped} (psf)= 85 (Pedestrian live load)
 M_{ped} (k-ft)= 359 (Ped moment per beam)
 V_{ped} (k)= 22 (Ped shear per beam)

Floorbeam:

Floor beam spacing (ft)= 5
No. of floor beams = 13
 P_{wheel} (kip)= 12
 M_{ll} (k-ft)= 60.0

(Moment = $P \cdot a$, where a is the distance from the curb to the wheel, see AISC beam tables for simply support beam with two point loads equi-distant from end)

Dead Load

Girder:

Assume a W40x149

w_{girder} (plf)= 149
 M_{girder} (k-ft)= 79
 $M_{fbongirder}$ (k-ft)= 44 (Moment from the floor beams on the girder assuming the load is uniformly distributed on girder)
 t_{slab} (in)= 8
 $w_{slabongirder}$ (plf)= 800
 $M_{slabongirder}$ (k-ft)= 423 (Moment from the slab on the girder assuming the load is uniformly distributed on girder)
 $w_{railing}$ (plf)= 75
 $M_{railingongirder}$ (k-ft)= 39.6

Floorbeam:

Assume a W10x49

$w_{floorbeam}$ (plf)= 49
 M_{fb} (k-ft)= 1.57
 $M_{slabonfb}$ (k-ft)= 16.00 (Moment from the slab on the floor beam)

Dead Load + Live Load + Impact

Girder:

$M_{totgirder}$ (k-ft)= 1030.3

Floor Beam:

$M_{totfloorbeam}$ (k-ft)= 17.57

Allowable Bending Stress:

Girder:

the girder has an unbraced top flange, therefore reduce the bending stress per AASHTO Table 10.32.1A

$$F_b = (50 \times 10^6 \cdot C_b / S_{xc}) \cdot (I_{yc} / l) \cdot (0.772 \cdot (J / I_{yc}) + 9.87 (d / l)^2)^{0.5} \leq 0.55 F_y$$

Assume a W40x149

w_{girder} (plf)= 149
 S_{xc} (in³)= 512
 t_w (in)= 0.63
 t_f (in)= 0.83
 b_f (in)= 11.81



Vanasse Hangen Brustlin, Inc.

Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Through Girder Estimate - Bass River		

d (in) = 38.2
 I_{yc} (in⁴) = 113.93
 I (in) = 195 (assume top flange to be braced at 1/4 points)
 J (in⁴) = 7.69
 C_b = 1.75 (pinned at both ends)
 F_b (ksi) = 27.50

Check Bending:

f_b (ksi) = 24.15
Check = OK

Floor Beam:

Assume a W10x49

$W_{\text{floorbeam}}$ (plf) = 49
 F_b (ksi) = 27.5
 S_x (in³) = 54.6
 f_b (ksi) = 13.19
Check = OK

Cost Estimate:

Steel Cost (\$/lb) = \$2.00 (Based on 2005 MHD Bridge Manual 20 of 24 and increased for inflation and current prices)

Girder: lbs = 19370

Floor Beam: lbs = 10192

Misc Steel: lbs = 5912 (Assume an additional 20% for steel to account for connections and preliminary nature of calc)

Σ = 35474

\$70,949

Concrete Cost (\$/yd) = \$700.00 (Based on 2005 MHD Bridge Manual 21 of 24 and increased for inflation and current prices)

Cubic Yards = 26

Cost = \$17,975

Reinf. Steel Cost (\$/lb) = \$1.50 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

lbs = 5136 (Assume 200lbs per cubic yard for deck concrete)

Cost = \$7,704

Railing Cost (\$/ft) = \$150.00 (Based on 2005 MHD Bridge Manual costs)

LF Railing = 130

Cost = \$19,500

Demo Exst. Bridge (\$) = \$43,500 (See hand calcs)

Abut. Rehab (\$) = \$30,000 (See hand calcs for Rehab Exst.)

Mob. / Demob. (\$) = \$20,000

Subtotal = \$209,628

Contingency = 20.0%

Total = \$251,553

Say = \$252,000



Computations

Project: CCRT

Location: Yarmouth, MA

Calculated by: R. Benfield

Checked by:

Title

Project # 09794

Sheet of

Date: 4/1/07

Date:

BRIDGE DEMO-

SQUARE YARDS OF BRIDGE DEMO :

L = 65'

W = SAY 8'

$$65 \times 8 = 520 \text{ SF} / 9 = \underline{\underline{58 \text{ SY}}}$$

FROM MHD BRIDGE MANUAL : SAY \$ 750 / SY

$$\$ 750 / \text{SY} \times 58 \text{ SY} = \boxed{\$ 43500}$$



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Precast Conc. Beam Estimate - Bass River		

Precast / Prestressed Concrete Beam - Preliminary Design

Geometry:

Span (ft) = 65
Width (ft) = 16

Cost Estimate:

Precast Beam Cost (\$/lb) = \$300.00 (Based on 2005 MHD Bridge Manual 14 of 24 and increased for inflation and current prices)

LF Beam = 260 (Assumes 4 beams will be needed)

Cost = \$78,000

Concrete Cost (\$/yd) = \$700.00 (Based on 2005 MHD Bridge Manual 21 of 24 and increased for inflation and current prices)

Cubic Yards = 5

Cost = \$3,792

Reinf. Steel Cost (\$/lb) = \$1.50 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

lbs = 813 (Assume 150lbs per cubic yard)

Cost = \$1,219

Membrane WP (\$/SY) = \$125.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

Area (SY) = 116

Cost = \$14,444

Binder Course (\$/Ton) = \$100.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)

Tons = 10

Cost = \$975

Pavement (\$/Ton) = \$75.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)

Tons = 10

Cost = \$731

Railing Cost (\$/ft) = \$150.00 (Based on 2005 MHD Bridge Manual costs)

LF Railing = 130

Cost = \$19,500

Demo Exst. Bridge (\$) = \$43,500 (See hand calcs for Steel Girder Option)

Abut. Rehab (\$) = \$30,000 (See hand calcs for Rehab Exst.)

Mob. / Demob. (\$) = \$20,000

Subtotal = \$212,161

Contingency = 20.0%

Total = \$254,593

Say = \$255,000



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Prefab Steel Truss Estimate - Bass River		

Prefab Steel Truss - Preliminary Design

Geometry:

Span (ft)= 65
Width (ft)= 16

Cost Estimate:

Prefab Truss Cost (\$/LF)= \$1,300.00 (Based on Information from Contech Bridge)
LF = 65 (Designed and delivered to site)
\$84,500

Truss Install Cost (\$/SF)= \$40.00 (Based on Information from Contech Bridge)
SF = 1040 (Designed and delivered to site)
\$41,600

Railing Cost (\$/ft)= \$150.00 (Based on 2005 MHD Bridge Manual costs)
LF Railing = 130
Cost = \$19,500

Demo Exst. Bridge (\$) = \$43,500 (See hand calcs for Steel Girder Option)

Abut. Rehab (\$) = \$30,000 (See hand calcs for Rehab Exst.)

Mob. / Demob. (\$) = \$10,000 (Only 50% of other superstructure options, truss install costs are accounted for elsewhere)

Subtotal = \$229,100
Contingency = 20.0%
Total = \$274,920

Say = \$275,000



4021 Gault Avenue South
Fort Payne, AL 35967
(256) 845-0154
(800) 749-7515
Fax: (256) 845-9750
www.steadfastbridge.com

DATE: August 22, 2006
TO: VHB
ATTN: PETER CHIU
PHONE: 401-272-8100
FAX: 401-273-9694
RE: CAPE COD BIKE PATH BRIDGE

We are pleased to quote you a price on the Continental Bridge described below. The floor will be a 22 gage galvanized composite floor deck. Reinforcing steel and pouring of the lightweight concrete shall be by the owner or contractor. This bridge will be fabricated from A588 Weathering Steel. This will provide a "maintenance free" bridge. All Continental Bridges carry a 10 year limited warranty. Shop drawings signed and sealed by a Professional Engineer registered in the State of Massachusetts will be provided.

Location: YARMOUTH, MA

Bridge Type:	Connector
Width in feet	14'-0"
Span in feet	80'-0"
Type steel	A588 WX
Type floor	CONCRETE
Floor thickness	5"
Field splice	YES
Number of pieces	4
Dead Load PSF	70
Live Load PSF	85
Vehicle Load LBS.	20,000
Design stresses	AASHTO
Lifting Weight LBS.	39368.4
Vert. abutment load KIPS	86.8
Horiz. abutment load KIPS	7.7
Truss height in feet	5.5
Interior panel points	12
Toe plates	NO
Railing height	54"
Maximum rail openings	4"

SAY \$90,000/80LF
= \$1125/LF

FOR 14' WIDE TRUSS

\$1125/LF x (16/14)
= \$1286/LF

SAY \$1300/LF

GRUP, MOBIL, ETC
5%

Bridge cost delivered

\$ 88,025.00 x 1.05 = SM \$93,000

Delivery: 12 to 14 weeks (delivery schedule subject to backlog at time of drawing approval).

Bridge will be delivered to nearest location easily accessible to over-the-road trucks.

Teflon slip pads and setting plates shipped with bridge.

Anchor bolts, sales tax, unloading, erection, supports, and abutment designs not included.

Terms: 1/3 down, balance 20 days after delivery, pending credit approval.

This quote is valid for 90 days. Please call if you have any questions (800-749-7515).

Scott Dempsey
Estimator

Accepted By: _____
Title / Date: _____





Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Prefab Timber Truss Estimate - Bass River		

Prefab Timber Truss - Preliminary Design

Geometry:

Span (ft) = 65
Width (ft) = 16

Cost Estimate:

Prefab Truss Cost (\$/SF) = \$90.00 (Based on information from Western Wood Structures)
SF = 1040 (Designed and delivered to site)
\$93,600

Truss Install Cost (\$/SF) = \$40.00 (Based on information from Contech Bridge)
SF = 1040 (Designed and delivered to site)
\$41,600

Railing Cost (\$/ft) = \$150.00 (Based on 2005 MHD Bridge Manual costs)
LF Railing = 130
Cost = \$19,500

Demo Exst. Bridge (\$) = \$43,500 (See hand calcs for Steel Girder Option)

Abut. Rehab (\$) = \$30,000 (See hand calcs for Rehab Exist.)

Mob. / Demob. (\$) = \$10,000 (Only 50% of other superstructure options, truss install costs are accounted for elsewhere)

Subtotal = \$238,200
Contingency = 20.0%
Total = \$285,840

Say = \$286,000

Collins, Andrew

From: Hazen Hyland [hazenh@westernwoodstructures.com]
Sent: Tuesday, September 12, 2006 12:15 PM
To: Collins, Andrew
Subject: RE:

Andy,

Yes, we offer bowstring truss bridges in spans less than 100'. 65' is an adequate length for a bowstring truss bridge. On a 100' pony truss or bowstring truss bridge, figure installation of 8-10 days with 4 bodies. I'm just shooting from the hip, as it could go faster depending on the crew. Basically you build the bridge on the ground, then make one pick with a crane.

Wood vs. Steel...obviously the natural look of wood usually fits well in any surrounding environment. All our products are customer, as in we can make your bridge length precisely what you need. If you want a unique looking rail, we can work with you to attain this. If anything happens to your bridge in the first year, we will fix it. Our 1 year warranty is offered because any bridge problem will usually occur in the first year.

Installation costs: Approximately (40-\$45) per square foot, and this doesn't include the crane cost. I'd have to first research what crane costs run in your neck of the woods.

Good questions,

IF WESTERNWOOD STRUCT. INSTALLS IT (PREMIUM)
FOR WESTFIELD BIKE PATH CALCULATED ^{\$}53/sf

Hazen Hyland
Western Wood Structures, Inc. - est. 1969
20675 SW 105th Ave
PO Box 130
Tualatin, OR 97062
www.westernwoodstructures.com

(800) 547 - 5411 phone
(503) 692 - 6434 fax

-----Original Message-----

From: Collins, Andrew [mailto:ACollins@VHB.com]
Sent: Tuesday, September 12, 2006 8:36 AM
To: Hazen Hyland
Subject: RE:

This is a huge help, thanks a ton.

Do you have the bow string option for spans less than 100'? Also, about how long does it take the contractor to assemble the truss and about how many workers does it require? If its not too much trouble would you send me your estimate for installation?

The timber option seems to be competitive with the steel truss option. If you can offer any additional talking points as to why timber is advantageous over steel I'd appreciate it.

Thanks very much,
Andy

9/12/2006

From: Hazen Hyland [mailto:hazenh@westernwoodstructures.com]

Sent: Tuesday, September 12, 2006 11:17 AM

To: Collins, Andrew

Subject:

Andy,

I've included some details of previous projects in the attachments above.

Budgetary per square foot prices for a pony truss Timber Bridge.

14' x 65' - \$86 to \$88 } FOR ESTIMATING SAY \$90/SF $\cdot 90 \times 14' = \$1260$
 14' x 100' - \$84 to \$86

If you need an abutment design (I realize you're trying to reuse the existing abutments), this is something we offer. Cost for abutment design (regardless of bridge length): \$1,700.

Above prices include design, supply, and delivery of all bridge materials. Because materials are predrilled and precut, the bridge is ready for installation upon arrival.

Another option, and I'm just throwing it out there, is a bowstring truss bridge. There's more height to this bridge, something you maybe trying to avoid, but the arch makes the bridge somewhat distinguishable). The PSF cost of a bowstring truss bridge 100' long is the same price as a pony truss bridge.

Since you've been on our website, you've probably already filtered out the bridge types you are not interested in. However if you are interested in seeing photos of a bowstring truss bridge, click on the "Teufel Nursery Bridge" picture on our home page (it's one of the rotating pictures).

If you need budgetary installation figures, we can provide them.

Thank you Andy,

Hazen Hyland
 Western Wood Structures, Inc. - est. 1969
 20675 SW 105th Ave
 PO Box 130
 Tualatin, OR 97062
www.westernwoodstructures.com

(800) 547 - 5411 phone
 (503) 692 - 6434 fax

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Vanasse Hangen Brustlin, Inc. 101 Walnut St
 Watertown, MA 02472
 617-924-1770

Collins, Andrew

From: Hazen Hyland [hazenh@westernwoodstructures.com]

Sent: Tuesday, September 12, 2006 11:17 AM

To: Collins, Andrew

Attachments: pony truss bridge.pdf; bowstring truss bridge.pdf

Andy,

I've included some details of previous projects in the attachments above.

Budgetary per square foot prices for a pony truss Timber Bridge.

14' x 65' - \$86 to \$88

14' x 100' - \$84 to \$86

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Thank you Andy,

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9/12/2006

Transportation
Land Development
Environmental
Services



Vanasse Hangen Brustlin, Inc.

101 Walnut Street

Post Office Box 9151

Watertown

Massachusetts 02471-9151

617.924.1770

FAX 617.924.2286

**Phone
Notes**

Person Contacted:

Title:

Company: *Western Wood*

Telephone No.:

FAX No.:

VHB Rep: *Andy Collins*

VHB Project No.: *09794*

Project Name:

Type of Call:

Date and Time:

10,000 lb Vehicle

14 x 65

14 x 100



*He will provide estimate for both spans
and both truss and girder*

Truss Style

or

Girder Style



*For 65' They can do both truss
and girder*

*life span → 50 years conservatively, but most likely
longer, 60-70 years*



Computations

Project:

Project #

Location:

Sheet of

Calculated by:

Date:

Checked by:

Date:

Title

STATION AVE COST BREAKDOWN

Station Ave - Cost Summary

Alternative	Cost
A: Steel Girder Bridge	\$919,000
B: Precast Concrete Box Girder Bridge	\$914,000
C: Prefabricated Steel Truss Bridge	\$911,000
D: Prefabricated Timber Truss Bridge	\$924,000
E: Precast Concrete Tunnel	\$983,000
F: Steel Invert Tunnel	\$919,000



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Through Girder Estimate - Station Ave		

Through Girder Preliminary Design

Geometry

Span (ft) = 80
Width (ft) = 16 (Curb to curb)

Live Load Girder:

Loading = HS15
 m_{H20} (k-ft) = 873.7 (AASHTO 17th Ed., pg 693)
 V_{H20} (k) = 47.70
 $I = 1.3$ (Impact)
 M_{H20} (k-ft) = 568
 V_{H20} (k) = 31
 w_{ped} (psf) = 85 (Pedestrian live load)
 M_{ped} (k-ft) = 544
 V_{ped} (k) = 27

Floorbeam:

Floor beam spacing (ft) = 5
No. of floor beams = 16
 P_{wheel} (kip) = 12
 M_{ll} (k-ft) = 60.0 (Moment = $P \cdot a$, where a is the distance from the curb to the wheel, see AISC beam tables for simply support beam with two point loads equi-distant from end)

Dead Load Girder:

Assume a W40x215

w_{girder} (plf) = 215
 M_{girder} (k-ft) = 172
 $M_{fbongirder}$ (k-ft) = 54 (Moment from the floor beams on the girder assuming the load is uniformly distributed on girder)
 t_{slab} (in) = 8
 $w_{slabongirder}$ (plf) = 800
 $M_{slabongirder}$ (k-ft) = 640 (Moment from the slab on the girder assuming the load is uniformly distributed on girder)
 $w_{railing}$ (plf) = 75
 $M_{railingongirder}$ (k-ft) = 60.0

Floorbeam:

Assume a W10x49

$w_{floorbeam}$ (plf) = 49
 M_{fb} (k-ft) = 1.57
 $M_{slabonfb}$ (k-ft) = 16.00 (Moment from the slab on the floor beam)

Dead Load + Live Load + Impact

Girder:

$M_{totgirder}$ (k-ft) = 1494.0

Floor Beam:

$M_{totfloorbeam}$ (k-ft) = 17.57

Allowable Bending Stress:

Girder:

the girder has an unbraced top flange, therefore reduce the bending stress per AASHTO Table 10.32.1A

$$F_b = (50 \times 10^{-6} \cdot C_b / S_{xc}) \cdot (I_{yc} / l) \cdot (0.772 \cdot (J / I_{yc}) + 9.87 (d / l)^2)^{0.5} \leq 0.55 F_y$$

Assume a W40x215

w_{girder} (plf) = 235
 S_{xc} (in³) = 858
 t_w (in) = 0.65
 t_f (in) = 1.22
 b_f (in) = 15.75
 d (in) = 38.98
 I_{yc} (in⁴) = 397.21
 l (in) = 240 (assume top flange to be braced at 1/4 points)
 J (in⁴) = 22.63
 C_b = 1.75 (pinned at both ends)



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Through Girder Estimate - Station Ave		

$$F_b \text{ (ksi)} = 27.50$$

Check Bending:

$$f_b \text{ (ksi)} = 20.90$$

Check= OK

Floor Beam:

Assume a W10x49

$$W_{\text{floorbeam}} \text{ (plf)} = 49$$

$$F_b \text{ (ksi)} = 27.5$$

$$S_x \text{ (in}^3\text{)} = 54.6$$

$$f_b \text{ (ksi)} = 13.19$$

Check= OK

Cost Estimate:

$$\text{Steel Cost (\$/lb)} = \$2.00 \quad (\text{Based on 2005 MHD Bridge Manual 20 of 24 and increased for inflation and current prices})$$

$$\text{Girder: lbs} = 37600$$

$$\text{Floor Beam: lbs} = 12544$$

$$\text{Misc Steel: lbs} = 10029 \quad (\text{Assume an additional 20\% for steel to account for connections and preliminary nature of calc})$$

$$\Sigma = 60173$$

$$\text{Cost} = \$120,346$$

$$\text{Concrete Cost (\$/yd)} = \$700.00 \quad (\text{Based on 2005 MHD Bridge Manual 21 of 24 and increased for inflation and current prices})$$

$$\text{Cubic Yards} = 32 \quad (\text{Deck concrete only})$$

$$\text{Cost} = \$22,123$$

$$\text{Reinf. Steel Cost (\$/lb)} = \$1.50 \quad (\text{Based on 2005 MHD Bridge Manual costs and increased for inflation})$$

$$\text{lbs} = 6321 \quad (\text{Assume 200lbs per cubic yard})$$

$$\text{Cost} = \$9,481$$

$$\text{Railing Cost (\$/ft)} = \$150.00 \quad (\text{Based on 2005 MHD Bridge Manual costs})$$

$$\text{LF Railing} = 160$$

$$\text{Cost} = \$24,000$$

$$\text{HDPE Railing Cost (\$/ft)} = \$35.00 \quad (\text{Based on Shining Sea Bikepath costs})$$

$$\text{LF Railing} = 1520 \quad (\text{Based on 380ft approach ramps on both sides of bridge})$$

$$\text{Cost} = \$53,200$$

$$\text{Gravel Borrow (\$/CY)} = \$20.00 \quad (\text{Based on 2005 MHD Bridge Manual costs and increased for inflation})$$

$$\text{CY} = 15510 \quad (\text{Based on 380ft approach ramps on both sides of bridge})$$

$$\text{Cost} = \$310,200$$

$$\text{New Abutments (\$)} = \$156,000 \quad (\text{See hand calcs})$$

$$\text{Traffic Management (\$)} = \$50,000$$

$$\text{Mob Demob (\$)} = \$20,000$$

$$\text{Subtotal} = \$765,351$$

$$\text{Contingency} = 20.0\%$$

$$\text{Total} = \$918,421$$

$$\text{Say} = \$919,000$$

Project: CCRT

Location: Yarmouth, MA

Calculated by: RUP

Checked by:

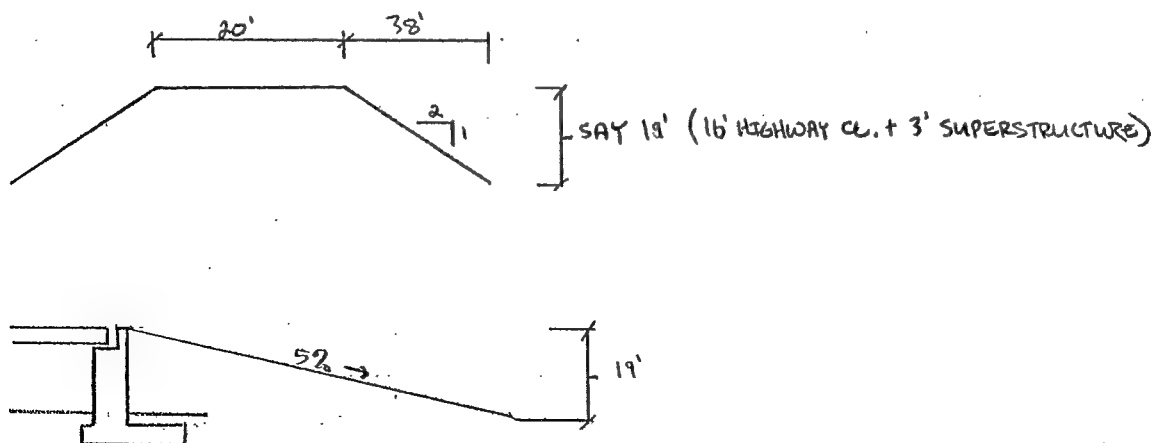
Title

Project # 07974

Sheet of

Date: 5/1/07

Date:

APPROACH RAMP -

$$\text{LENGTH OF RAMP REQ'D} = 19' / (0.05) = \underline{\underline{380 \text{ FT}}}$$

$$\text{AREA @ BRIDGE} = 20' \times 19' + 2 \left(\frac{38' \times 19'}{2} \right) = \underline{\underline{1102 \text{ SF}}}$$

$$\text{AREA @ END OF RAMP} = 0'$$

$$\text{VOLUME} = 1102 \text{ SF} \times \frac{380 \text{ FT}}{2} \times \frac{1}{27} = 7755 \text{ CY} \times 2 \text{ APPROACHES}$$

$$\boxed{= 15510 \text{ CY}}$$

HDPE RAILING -

$$380' \text{ RAMP} \times 2 \text{ SIDES} \times 2 \text{ APPROACHES} = \boxed{1520 \text{ LF}}$$



Computations

Project: CCRT

Location: Yarmouth, MA

Calculated by: RWP

Checked by:

Title

Project # 09794

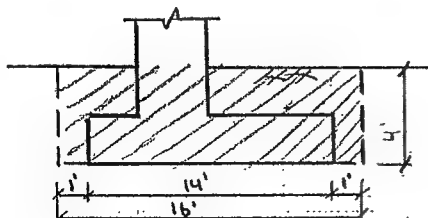
Sheet of

Date: 5/1/07

Date:

ABUTMENT COSTS -

BRIDGE EXCAVATION -



$$\text{VOLUME} = 16' \times 22' \times 4' \times \frac{1}{27} \times 2 = \underline{\underline{110.5 \text{ CY}}}$$

$$\text{FROM MHD BRIDGE MANUAL} = \$20/\text{CY}$$

$$\text{TOTAL} = 105 \text{ CY} \times \$20/\text{CY} = \boxed{\$2100}$$

GRAVEL BORROW -

$$7' \text{ WIDE} \times 20' \text{ HIGH} \times 20' \text{ LONG} \times \frac{1}{27} \times 2 = \underline{\underline{208 \text{ CY}}}$$

$$\text{FROM MHD BRIDGE MANUAL} = \$25/\text{CY}$$

$$\text{TOTAL} = 208 \text{ CY} \times \$25/\text{CY} = \boxed{\$5200}$$

BITUMINOUS DAMPPROOFING -

$$20' \text{ WIDE} \times 20' \text{ LONG} \times \frac{1}{9} \times 2 = 89 \text{ SY}$$

$$\text{FROM MHD BRIDGE MANUAL} = \$11/\text{SY}$$

$$\text{TOTAL} = 89 \times 11 = \boxed{\$1000}$$

Project: CCRT.

Location: Yarmouth, NS

Calculated by: RWP

Checked by:

Title

Project # 09794

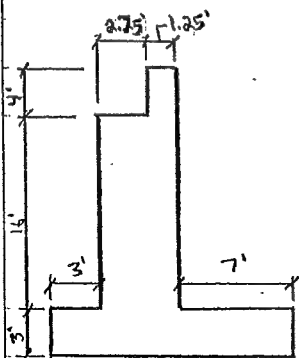
Sheet of

Date: 5/1/07

Date:

ABUTMENT COSTS -

CLASS A. CONCRETE - (SAY 20' WIDE ABUTMENTS)



$$\text{FIG. } 14' \times 3' \times 20' \text{ LONG} \times \frac{1}{27} \times 2 = 63 \text{ CY}$$

$$\text{STEM. } 4' \times 16' \times 20' \times \frac{1}{27} \times 2 = 95 \text{ CY}$$

$$\text{BOXWALL } 4' \times 1.25' \times 20' \times \frac{1}{27} \times 2 = 8 \text{ CY}$$

$$\text{TOTAL} = \underline{\underline{166 \text{ CY}}}$$

$$\text{FROM MHD BRIDGE MANUAL} = \$600/\text{CY}$$

$$\text{TOTAL} = \$600 \times 166$$

$$= \$100,000$$

STEEL REINFORCEMENT -

$$\text{SAY } 150\#/\text{CY} \quad 150\#/\text{CY} \times 166 \text{ CY} = \underline{\underline{24900\#}}$$

$$\text{FROM MHD BRIDGE MANUAL} \rightarrow \text{REBAR} = \$1.50/\#$$

$$\text{TOTAL} = \$1.50/\# \times 24900\#$$

$$= \$37350$$

BEARING PADS -

$$\text{SAY } \$10000 \quad (\text{BASIC ASSUMPTION})$$

$$= \$10000$$

GRAND TOTAL

$$2100 + 5200 + 1000 + 100000 + 37350 + 10000 = \$156000.00$$



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Precast Conc. Beam Estimate - Station Ave		

Precast Concrete Beam - Preliminary Design

Geometry

Span (ft) = 80

Width (ft) = 16

Cost Estimate:

Precast Beam Cost (\$/lb) = \$375.00 (Based on 2005 MHD Bridge Manual 14 of 24 and increased for inflation and current prices)

LF Beam = 320 (Assumes 4 beams will be needed)

Cost = \$120,000

Concrete Cost (\$/yd) = \$700.00 (Based on 2005 MHD Bridge Manual 21 of 24 and increased for inflation and current prices)

Cubic Yards = 7

Cost = \$4,667

Reinf. Steel Cost (\$/lb) = \$1.50 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

lbs = 1000 (Assume 150lbs per cubic yard)

Cost = \$1,500

Membrane WP (\$/SY) = \$125.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

Area (SY) = 142

Cost = \$17,778

Binder Course (\$/Ton) = \$200.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)

Tons = 12

Cost = \$2,400

Pavement (\$/Ton) = \$150.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)

Tons = 12

Cost = \$1,800

Railing Cost (\$/ft) = \$150.00 (Based on 2005 MHD Bridge Manual costs)

LF Railing = 160

Cost = \$24,000

HDPE Railing Cost (\$/ft) = \$35.00 (Based on Shining Sea Bikepath costs)

LF Railing = 1520 (Based on 380ft approach ramps on both sides of bridge)

Cost = \$53,200

Gravel Borrow (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

CY = 15510 (Based on 380ft approach ramps on both sides of bridge)

Cost = \$310,200

New Abutments (\$) = \$156,000 (See hand calcs)

Traffic Management (\$) = \$50,000

Mob Demob (\$) = \$20,000

Subtotal = \$761,544

Contingency = 20.0%

Total = \$913,853

Say = \$914,000



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Prefab Steel Truss Estimate - Station Ave		

Prefab Steel Truss - Preliminary Design

Geometry

Span (ft)= 80
Width (ft)= 16

Cost Estimate:

Prefab Truss Cost (\$/LF)= \$1,300.00 (Based on information from Contech Bridge)
LF = 80 (Designed and delivered to site)
\$104,000

Truss Install Cost (\$/SF)= \$40.00 (Based on information from Contech Bridge)
SF = 1280 (Designed and delivered to site)
\$51,200

Railing Cost (\$/ft)= \$150.00 (Based on 2005 MHD Bridge Manual costs)
LF Railing = 160
Cost = \$24,000

HDPE Railing Cost (\$/ft)= \$35.00 (Based on Shining Sea Bikepath costs)
LF Railing = 1520 (Based on 380ft approach ramps on both sides of bridge)
Cost = \$53,200

Gravel Borrow (\$/CY)= \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 15510 (Based on 380ft approach ramps on both sides of bridge)
Cost = \$310,200

New Abutments (\$) = \$156,000 (See hand calcs)

Traffic Management (\$) = \$50,000

Mob Demob (\$) = \$10,000 (Only 50% of other superstructure options, truss install costs are accounted for elsewhere)

Subtotal = \$758,600
Contingency= 20.0%
Total = \$910,320
Say = \$911,000



4021 Gault Avenue South
Fort Payne, AL 35967
(256) 845-0154
(800) 749-7515
Fax: (256) 845-9750
www.steadfastbridge.com

DATE: August 22, 2006
TO: VHB
ATTN: PETER CHIU
PHONE: 401-272-8100
FAX: 401-273-9694
RE: CAPE COD BIKE PATH BRIDGE

We are pleased to quote you a price on the Continental Bridge described below. The floor will be a 22 gage galvanized composite floor deck. Reinforcing steel and pouring of the lightweight concrete shall be by the owner or contractor. This bridge will be fabricated from A588 Weathering Steel. This will provide a "maintenance free" bridge. All Continental Bridges carry a 10 year limited warranty. Shop drawings signed and sealed by a Professional Engineer registered in the State of Massachusetts will be provided.

Location: YARMOUTH, MA

Bridge Type:	Connector
Width in feet	14'-0"
Span in feet	80'-0"
Type steel	A588 WX
Type floor	CONCRETE
Floor thickness	5"
Field splice	YES
Number of pieces	4
Dead Load PSF	70
Live Load PSF	85
Vehicle Load LBS.	20,000
Design stresses	AASHTO
Lifting Weight LBS.	39368.4
Vert. abutment load KIPS	86.8
Horiz. abutment load KIPS	7.7
Truss height in feet	5.5
Interior panel points	12
Toe plates	NO
Railing height	54"
Maximum rail openings	4"

SAY \$90,000/80 LF
= \$1125/LF

FOR 14' WIDE TRUSS

\$1125/LF x (16/14)
= \$1286/LF

SAY \$1300/LF

GRUP, MOBIL ETC
5%

Bridge cost delivered

\$ 88,025.00 x 1.05 = \$92,426.25

Delivery: 12 to 14 weeks (delivery schedule subject to backlog at time of drawing approval).
Bridge will be delivered to nearest location easily accessible to over-the-road trucks.
Teflon slip pads and setting plates shipped with bridge.
Anchor bolts, sales tax, unloading, erection, supports, and abutment designs not included.
Terms: 1/3 down, balance 20 days after delivery, pending credit approval.
This quote is valid for 90 days. Please call if you have any questions (800-749-7515).

Scott Dempsey
Estimator

Accepted By: _____
Title / Date: _____





Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Prefab Timber Truss Estimate - Station Ave		

Prefab Timber Truss - Preliminary Design

Geometry

Span (ft)= 80
Width (ft)= 16 (Curb to curb)

Cost Estimate:

Prefab Truss Cost (\$/SF)= \$90.00 (Based on information from Western Wood Structures)
SF = 1280 (Designed and delivered to site)
\$115,200

Truss Install Cost (\$/SF)= \$40.00 (Based on information from Contech Bridge)
SF = 1280 (Designed and delivered to site)
\$51,200

Railing Cost (\$/ft)= \$150.00 (Based on 2005 MHD Bridge Manual costs)
LF Railing = 160
Cost = \$24,000

HDPE Railing Cost (\$/ft)= \$35.00 (Based on Shining Sea Bikepath costs)
LF Railing = 1520 (Based on 380ft approach ramps on both sides of bridge)
Cost = \$53,200

Gravel Borrow (\$/CY)= \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 15510 (Based on 380ft approach ramps on both sides of bridge)
Cost = \$310,200

New Abutments (\$) = \$156,000 (See hand calcs)

Traffic Management (\$) = \$50,000

Mob Demob (\$) = \$10,000 (Only 50% of other superstructure options, truss install costs are accounted for elsewhere)

Subtotal = \$769,800
Contingency= 20.0%
Total = \$923,760

Say = \$924,000

Collins, Andrew

From: Hazen Hyland [hazenh@westernwoodstructures.com]
Sent: Tuesday, September 12, 2006 12:15 PM
To: Collins, Andrew
Subject: RE:

Andy,

Yes, we offer bowstring truss bridges in spans less than 100'. 65' is an adequate length for a bowstring truss bridge. On a 100' pony truss or bowstring truss bridge, figure installation of 8-10 days with 4 bodies. I'm just shooting from the hip, as it could go faster depending on the crew. Basically you build the bridge on the ground, then make one pick with a crane.

Wood vs. Steel...obviously the natural look of wood usually fits well in any surrounding environment. All our products are customer, as in we can make your bridge length precisely what you need. If you want a unique looking rail, we can work with you to attain this. If anything happens to your bridge in the first year, we will fix it. Our 1 year warranty is offered because any bridge problem will usually occur in the first year.

IF WESTERNWOOD STRUCT. INSTALLS IT (PREMIUM)

Installation costs: Approximately (40-\$45) per square foot, and this doesn't include the crane cost. I'd have to first research what crane costs run in your neck of the woods.

Good questions,

FOR WESTFIELD BIKE PATH CALCULATED $\approx \$53/sf$

Hazen Hyland
Western Wood Structures, Inc. - est. 1969
20675 SW 105th Ave
PO Box 130
Tualatin, OR 97062
www.westernwoodstructures.com

(800) 547 - 5411 phone
(503) 692 - 6434 fax

-----Original Message-----

From: Collins, Andrew [mailto:ACollins@VHB.com]
Sent: Tuesday, September 12, 2006 8:36 AM
To: Hazen Hyland
Subject: RE:

This is a huge help, thanks a ton.

Do you have the bow string option for spans less than 100'? Also, about how long does it take the contractor to assemble the truss and about how many workers does it require? If its not too much trouble would you send me your estimate for installation?

The timber option seems to be competitive with the steel truss option. If you can offer any additional talking points as to why timber is advantageous over steel I'd appreciate it.

Thanks very much,
Andy

From: Hazen Hyland [mailto:hazenhyland@westernwoodstructures.com]
Sent: Tuesday, September 12, 2006 11:17 AM
To: Collins, Andrew
Subject:

Andy,

I've included some details of previous projects in the attachments above.

Budgetary per square foot prices for a pony truss Timber Bridge.

14' x 65' - \$86 to \$88 } FOR ESTIMATING SAY $\$90/\text{SF} \cdot 90 \times 14' = \1260
 14' x 100' - \$84 to \$86

If you need an abutment design (I realize you're trying to reuse the existing abutments), this is something we offer. Cost for abutment design (regardless of bridge length): \$1,700.

Above prices include design, supply, and delivery of all bridge materials. Because materials are predrilled and precut, the bridge is ready for installation upon arrival.

Another option, and I'm just throwing it out there, is a bowstring truss bridge. There's more height to this bridge, something you maybe trying to avoid, but the arch makes the bridge somewhat distinguishable). The PSF cost of a bowstring truss bridge 100' long is the same price as a pony truss bridge.

Since you've been on our website, you've probably already filtered out the bridge types you are not interested in. However if you are interested in seeing photos of a bowstring truss bridge, click on the "Teufel Nursery Bridge" picture on our home page (it's one of the rotating pictures).

If you need budgetary installation figures, we can provide them.

Thank you Andy,

Hazen Hyland
Western Wood Structures, Inc. - est. 1969
 20675 SW 105th Ave.
 PO Box 130
 Tualatin, OR 97062
www.westernwoodstructures.com

(800) 547 - 5411 phone
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 Vanasse Hangen Brustlin, Inc. 101 Walnut St
 Watertown, MA 02472
 617-924-1770

Collins, Andrew

From: Hazen Hyland [hazenh@westernwoodstructures.com]
Sent: Tuesday, September 12, 2006 11:17 AM
To: Collins, Andrew
Attachments: pony truss bridge.pdf; bowstring truss bridge.pdf

Andy,

I've included some details of previous projects in the attachments above.

Budgetary per square foot prices for a pony truss Timber Bridge.

14' x 65' - \$86 to \$88
14' x 100' - \$84 to \$86

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Above prices include design, supply, and delivery of all bridge materials. Because materials are predrilled and precut, the bridge is ready for installation upon arrival.

Another option, and I'm just throwing it out there, is a bowstring truss bridge. There's more height to this bridge, something you maybe trying to avoid, but the arch makes the bridge somewhat distinguishable). The PSF cost of a bowstring truss bridge 100' long is the same price as a pony truss bridge.

Since you've been on our website, you've probably already filtered out the bridge types you are not interested in. However if you are interested in seeing photos of a bowstring truss bridge, click on the "Teufel Nursery Bridge" [picture](#) on our home page (it's one of the rotating pictures).

If you need budgetary installation figures, we can provide them.

Thank you Andy,

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Transportation
Land Development
Environmental
Services



Vanasse Hangen Brustlin, Inc.

101 Walnut Street

Post Office Box 9151

Watertown

Massachusetts 02471-9151

617.924.1770

FAX 617.924.2286

Phone
Notes

Person Contacted:

Title:

Company: *Western Wood*

Telephone No.:

FAX No.:

VHB Rep: *Andy Collins*

VHB Project No.: *09794*

Project Name:

Type of Call:

Date and Time:

10,000 lb Vehicle

14 x 65

14 x 100

} He will provide estimate for both spans
and both truss and girder

Truss Style

or

Girder Style

} For 65' They can do both truss
and girder

*like span → 50 years conservatively, but most likely
longer, 60-70 years*



Vanasse Hangen Brustlin, Inc.

Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Precast Tunnel Estimate - Station Ave		

Precast Concrete Tunnel - Preliminary Design

Geometry

Span (ft) = 80
Width (ft) = 16 (outside width)
Height (ft) = 15 (outside height)
Embedment (ft) = 2 (from roadway to top of culvert)

Cost Estimate:

Box Culvert Cost (\$/LF) = \$1,620.00 (See hand calc)

LF Tunnel = 80

Cost = \$129,600

Culvert Installation (\$/Day) = \$10,000.00

Days = 5.33 (Assume 15ft per day)

Cost = \$53,333

Bridge Excavation (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

CY = 960 (Assumes 1ft pay limit from all structures)

Cost = \$19,200

Unclassified Excav. (\$) = \$12.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

CY = 6970 (See hand calc)

Cost = \$83,640

Gravel Borrow (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

CY = 184 (Assume 1ft pay limit on all sides)

Cost = \$3,674

Bit. Dampproofing (\$/SY) = \$10.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

SY = 268

Cost = \$2,684

Bridge Railing (\$/LF) = \$150.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

LF = 152 (Equals width of culvert plus both wingwalls)

Cost = \$22,800

Binder Course (\$/Ton) = \$200.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)

Tons = 152 (Assumes new pavement length equals the culvert width plus both wingwall lengths)

Cost = \$30,400

Pavement (\$/Ton) = \$150.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)

Tons = 76 (Assumes new pavement length equals the culvert width plus both wingwall lengths)

Cost = \$11,400

Temp Shoring (\$/SY) = \$350.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

SY = 98 (Assumes tunnel will be constructed in two sections)

Cost = \$34,378

Lighting (\$) = \$26,000 (See hand calcs)

Drainage (\$) = \$13,000 (See hand calcs)

Wingwalls (\$) = \$235,730 (See hand calcs)

Traffic Management (\$) = \$100,000

Mob Demob (\$) = \$20,000

Subtotal = \$785,840

Contingency = 25.0%

Total = \$982,300

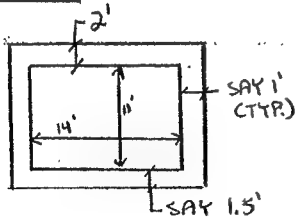
Say = \$983,000

Project: CCRT
 Location: Yarmouth, MA
 Calculated by: MWP
 Checked by:
 Title

Project # 09794
 Sheet of
 Date: 5/1/07
 Date:

PRECAST CONCRETE BOX GIRDER-

CONCRETE:



$$\begin{aligned} \text{ROOF: } 2' \times 14' &= 28 \text{ SF} \\ \text{WALLS: } 1' \times (11' + 2') \times 2 &= 26 \text{ SF} \\ \text{BASE: } 1.5' \times 14' &= 21 \text{ SF} \end{aligned}$$

$$\text{TOTAL} = \underline{\underline{75 \text{ SF/FT}}}$$

$$= 2.78 \text{ CY/FT SAY } \underline{\underline{3 \text{ CY}}}$$

REBAR:

$$\text{SAY } 200 \#/\text{CY} \quad 75/27 = 2.78 \text{ CY} \times 200 \#/\text{CY} = \underline{\underline{560 \#/\text{FT}}}$$

COSTS: (PER MHD)

(NOTES: CONCRETE AND REBAR COSTS ARE LESS BECAUSE INSTALLATION COSTS ARE ACCOUNTED FOR ELSEWHERE.)

$$\text{CONCRETE: } 3 \text{ CY @ } \$400/\text{CY} = \$1200/\text{LF}$$

$$\text{REBAR: } 560 \#/\text{FT @ } \$0.75/\# = \underline{\underline{420/\text{LF}}}$$

TOTAL

$$= \underline{\underline{\$1620/\text{LF}}}$$



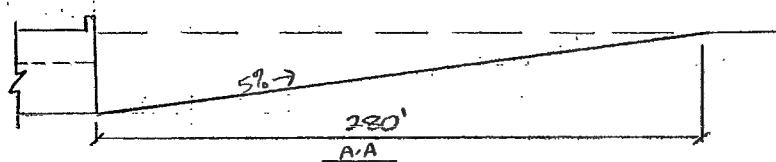
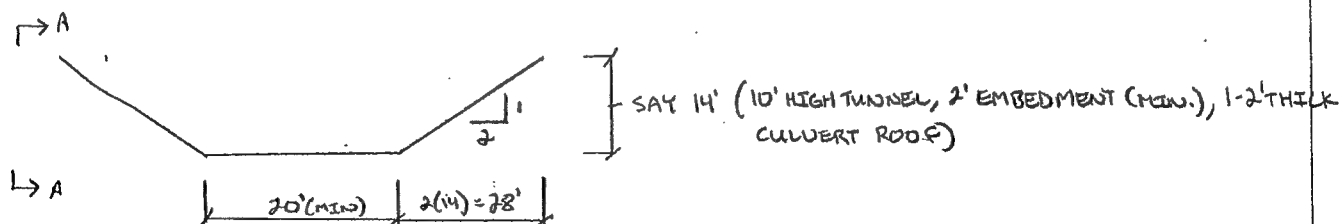
Computations

Project: CERT
 Location: Yarmouth, MA
 Calculated by: RWP
 Checked by:
 Title

Project # 09794
 Sheet of
 Date: 5/1/07
 Date:

UNCLASSIFIED EXCAVATION-

APPROACHES- (ASSUME 5% SLOPE REQUIRED)



$$14' / 0.05 = 280 \text{ LONG.}$$

$$\text{AREA @ CULVERT} \rightarrow 20' \times 14' + 28' \times 14' = 672 \text{ SF.}$$

$$\text{AREA @ TOP OF RAMP} \rightarrow = 0 \text{ SF}$$

$$\text{TOTAL VOLUME} = 672 \text{ SF} \times 280' \times \frac{1}{2} \times \frac{1}{27} = 3485 \text{ CY}$$

x 2 SIDES

$$\text{TOTAL} = \boxed{6970 \text{ CY}}$$

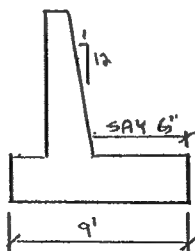
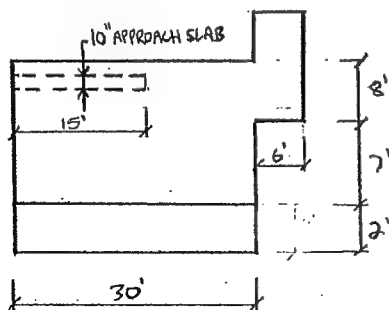


Computations

Project: CCRT
 Location: Yarmouth, MA
 Calculated by: RUP
 Checked by:
 Title

Project # 09794
 Sheet of
 Date: 5/1/07
 Date:

CULVERT WINGWALLS -



STEM: $1.0' \times 15' \times 30'$
 $((\frac{1}{2} \times 15) \times 15') \times 0.5 \times 30'$
 FTG: $2' \times 9' \times 30'$
 FLY WW: $8' \times 6' \times 1.0'$
 END POST: $5' \times 3.5' \times 1.0'$

= 450 CF
 = 282
 = 540
 = 48
 = 18

= 1338 CF x 4 WW = 5352 CF

APPROACH SLAB: $60' \times 15' \times 10''$ = 750 CF x 2

= 1500 CF

TOTAL = $(5352 + 1500) / 27$

= 254 CY

FROM MHD BRIDGE MANUAL \rightarrow \$600/CY = 254×600

= \$152400

WINGWALL REBAR-

ASSUME 150#/CY \rightarrow $254 \text{ CY} \times 150 \text{ \#/CY}$

= 38100 #

FROM MHD \rightarrow \$1.50/#

TOTAL = 38100×1.5

= \$57150



Computations

Project: CRT

Location: Yarmouth, MA

Calculated by: RWP

Checked by:

Title

Project # 09794

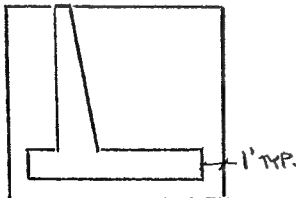
Sheet of

Date: 5/1/07

Date:

WINGWALLS - CONT -

BRIDGE EXCAVATION:



$$11' \times 16' \times 31' \times 4 \times \frac{1}{27}$$

$$= 809 \text{ CY}$$

$$\text{TOTAL} = 809 \text{ CY} \times \$20/\text{CY}$$

$$= \$16180$$

GRAVEL BORROW:

$$6' \times 15' \text{ HIGH} \times 30' \text{ LONG} \times 4 \text{ WINGWALLS} \times \frac{1}{27}$$

$$= 400 \text{ CY}$$

$$\text{TOTAL} = 400 \text{ CY} \times \$20/\text{CY}$$

$$= \$8000$$

BIT. DAMPPROOFING:

$$15' \text{ HIGH} \times 30' \text{ LONG} \times 4 \times \frac{1}{9}$$

$$= 200 \text{ SY}$$

$$\text{TOTAL} = 200 \text{ SY} \times \$10/\text{SY}$$

$$= \$2000$$

GRAND TOTAL:

$$\$152400 + 57150 + 16180 + 8000 + 2000$$

$$= \$235730$$



Vanasse Hangen Brustlin, Inc.

Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Steel Invert Tunnel Estimate - Station Ave		

Steel Invert Tunnel - Preliminary Design

Geometry

Span (ft) = 80
Width (ft) = 16 (outside width)
Height (ft) = 15 (outside height)
Embedment (ft) = 2 (from roadway to top of culvert)

Cost Estimate:

Steel Invert Cost (\$/LF) = \$600.00 (From Contech)
LF Tunnel = 80
Cost = \$48,000

Culvert Installation (\$/Day) = \$10,000.00
Days = 5.33 (Assume 15ft per day)
Cost = \$53,333

Bridge Excavation (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 960 (Assumes 1ft pay limit from all structures)
Cost = \$19,200

Unclassified Excav. (\$) = \$12.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 6970 (See hand calc)
Cost = \$83,640

Gravel Borrow (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 472 (Assume 1ft pay limit on all sides)
Cost = \$9,434

Concrete (\$/CY) = \$600.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 30 (See hand calc)
Cost = \$17,760

Rebar (\$/LB) = \$1.50 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
LB = 4440 (See hand calc)
Cost = \$6,660

Bit. Dampproofing (\$/SY) = \$10.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
SY = 268
Cost = \$2,684

Bridge Railing (\$/LF) = \$150.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
LF = 152 (Equals width of culvert plus both wingwalls)
Cost = \$22,800

Binder Course (\$/Ton) = \$200.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)
Tons = 152 (Assumes new pavement length equals the culvert width plus both wingwall lengths)
Cost = \$30,400

Pavement (\$/Ton) = \$150.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)
Tons = 76 (Assumes new pavement length equals the culvert width plus both wingwall lengths)
Cost = \$11,400

Temp Shoring (\$/SY) = \$350.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
SY = 98 (Assumes tunnel will be constructed in two sections)
Cost = \$34,378

Lighting (\$) = \$26,000 (See hand calcs)

Drainage (\$) = \$13,000 (See hand calcs)

Wingwalls (\$) = \$235,730 (See hand calcs)

Traffic Management (\$) = \$100,000

Mob Demob (\$) = \$20,000

Subtotal = \$734,420
Contingency = 25.0%
Total = \$918,025

Say = \$919,000

Project: CCRT

Project # 09794

Location: Yarmouth, MA

Sheet of

Calculated by: RUP

Date: 5/1/07

Checked by:

Date:

Title

CONCRETE FOR INVERT TUNNEL-

$$\begin{array}{ll}
 \text{CURB} & (0.75' \times 2' \times 2 \text{ SIDES}) \times \frac{1}{27} = 0.12 \text{ CY/LF} \\
 \text{INV. LINER} & (2\frac{1}{2} \times 15') \times \frac{1}{27} = 0.10 \text{ CY/LF} \\
 \text{COLLAR} & 1.5' \text{ THICK} \times [(15.5' \times 2.5') + (\frac{1}{2} \times 8' \times 8' \times 2)] \times \frac{1}{27} = 12.0 \text{ CY/LF}
 \end{array}
 \left. \begin{array}{l} \\ \\ \end{array} \right\} \underline{\underline{0.22 \text{ CY/LF}}}$$

$$\text{REBAR} - 150 \#/\text{CY} \rightarrow 12 \text{ CY} \times 150 = \underline{\underline{1800\# + 33\#/LF}}$$

GRAVEL BORROW-

$$\text{ABOVE THE ARCH} - [(15.5' \times 2') + (\frac{1}{2} \times 8' \times 8' \times 2)] \times \frac{1}{27} = \underline{\underline{3.6 \text{ CY/LF}}}$$



Computations

Project:

Project #

Location:

Sheet of

Calculated by:

Date:

Checked by:

Date:

Title

WILLOW STREET COST BREAKDOWN

Willow Street - Cost Summary

Alternative	Cost
A: Steel Girder Bridge	\$1,294,000
B: Precast Concrete Box Girder Bridge	\$1,285,000
C: Prefabricated Steel Truss Bridge	\$1,266,000
D: Prefabricated Timber Truss Bridge	\$1,293,000



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Through Girder Estimate - Willow Street		

Through Girder Preliminary Design

Geometry

Span (ft)= 80 (Total span is 160ft, with (2) equal clear spans)
Width (ft)= 16

Live Load Girder:

Loading= HS15
 m_{H20} (k-ft)= 873.7 (AASHTO 17th Ed., pg 693)
 v_{H20} (k)= 47.70
 I = 1.3 (Impact)
 M_{H20} (k-ft)= 568
 V_{H20} (k)= 31
 w_{ped} (psf)= 85 (Pedestrian live load)
 M_{ped} (k-ft)= 544
 V_{ped} (k)= 27

Floorbeam:

Floor beam spacing (ft)= 5
No. of floor beams = 16
 P_{wheel} (kip)= 12
 M_H (k-ft)= 60.0 (Moment = $P \cdot a$, where a is the distance from the curb to the wheel, see AISC beam tables for simply support beam with two point loads equi-distant from end)

Dead Load Girder:

Assume a W40x215
 w_{girder} (plf)= 215
 M_{girder} (k-ft)= 172
 $M_{fbongirder}$ (k-ft)= 54 (Moment from the floor beams on the girder assuming the load is uniformly distributed on girder)
 t_{slab} (in)= 8
 $w_{slabongirder}$ (plf)= 800
 $M_{slabongirder}$ (k-ft)= 640 (Moment from the slab on the girder assuming the load is uniformly distributed on girder)
 $w_{railing}$ (plf)= 75
 $M_{railingongirder}$ (k-ft)= 60.0

Floorbeam:

Assume a W10x49
 $w_{floorbeam}$ (plf)= 49
 M_{fb} (k-ft)= 1.57
 $M_{slabonfb}$ (k-ft)= 16.00 (Moment from the slab on the floor beam)

Dead Load + Live Load + Impact Girder:

$M_{totgird}$ (k-ft)= 1494.0

Floor Beam:

$M_{totffloorbeam}$ (k-ft)= 17.57

Allowable Bending Stress:

Girder: the girder has an unbraced top flange, therefore reduce the bending stress per AASHTO Table 10.32.1A
$$F_b = (50 \times 10^6 \cdot C_b / S_{xc}) \cdot (I_{yc} / l) \cdot (0.772 \cdot (J / I_{yc}) + 9.87 (d / l)^2)^{0.5} \leq 0.55 F_y$$

Assume a W40x215

w_{girder} (plf)= 235
 S_{xc} (in³)= 858
 t_w (in)= 0.65
 t_f (in)= 1.22
 b_f (in)= 15.75
 d (in)= 38.98
 I_{yc} (in⁴)= 397.21
 l (in)= 240 (assume top flange to be braced at 1/4 points)
 J (in⁴)= 22.63
 C_b = 1.75 (pinned at both ends)
 F_b (ksi)= 27.50



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Through Girder Estimate - Willow Street		

Check Bending:

f_b (ksi) = 20.90
Check = OK

Floor Beam:

Assume a W10x49

$W_{floorbeam}$ (plf) = 49
 F_b (ksi) = 27.5
 S_x (in³) = 54.6
 f_b (ksi) = 13.19
Check = OK

Cost Estimate:

Steel Cost (\$/lb) = \$2.00 (Based on 2005 MHD Bridge Manual 20 of 24 and increased for inflation and current prices)

Girder: lbs = 37600

Floor Beam: lbs = 12544

Misc Steel: lbs = 10029 (Assume an additional 20% for steel to account for connections and preliminary nature of calc)

Σ = 120346 (Doubled to account for (2) 80ft spans)

\$240,691

Concrete Cost (\$/yd) = \$700.00 (Based on 2005 MHD Bridge Manual 21 of 24 and increased for inflation and current prices)

Cubic Yards = 63 (Deck concrete only, doubled to account for (2) 80ft spans)

Cost = \$44,247

Reinf. Steel Cost (\$/lb) = \$1.50 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

lbs = 12642 (Assume 200lbs per cubic yard)

Cost = \$18,963

Railing Cost (\$/ft) = \$150.00 (Based on 2005 MHD Bridge Manual costs)

LF Railing = 320 (Doubled to account for (2) 80ft spans)

Cost = \$48,000

HDPE Railing Cost (\$/ft) = \$35.00 (Based on Shining Sea Bikepath costs)

LF Railing = 1520 (Based on 380ft approach ramps on both sides of bridge)

Cost = \$53,200

Gravel Borrow (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

CY = 15510 (Based on 380ft approach ramps on both sides of bridge)

Cost = \$310,200

New Abutments (\$) = \$156,000 (See hand calcs)

New Pier (\$) = \$36,500 (See hand calcs)

Traffic Management (\$) = \$50,000

Railroad Flagging (\$) = \$100,000

Mob Demob (\$) = \$20,000

Subtotal = \$1,077,801

Contingency = 20.0%

Total = \$1,293,361

Say = \$1,294,000



Computations

Project: CCRT

Location: Yarmouth, MA

Calculated by: RUP

Checked by:

Title

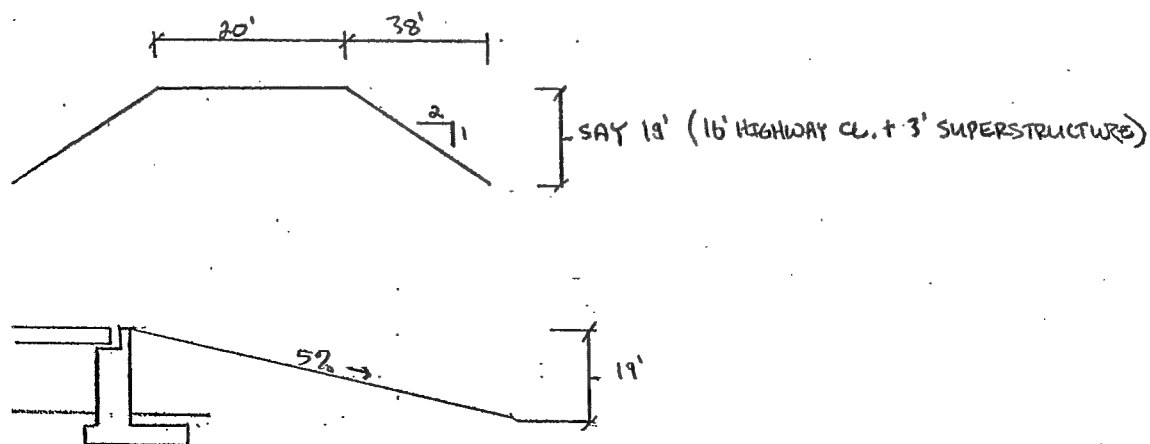
Project # 07974

Sheet of

Date: 5/1/07

Date:

APPROACH RAMPS -



$$\text{LENGTH OF RAMP REQ'D} = 19' / (0.05) = \underline{\underline{380 \text{ FT}}}$$

$$\text{AREA @ BRIDGE} = 20' \times 19' + 2 \left(\frac{38' \times 19'}{2} \right) = \underline{\underline{1102 \text{ SF}}}$$

$$\text{AREA @ END OF RAMP} = 0'$$

$$\text{VOLUME} = 1102 \text{ SF} \times \frac{380 \text{ FT}}{2} \times \frac{1}{27} = 7755 \text{ CY} \times 2 \text{ APPROACHES}$$

$$\boxed{= 15510 \text{ CY}}$$

HDPE RAILING -

$$380' \text{ RAMP} \times 2 \text{ SIDES} \times 2 \text{ APPROACHES} = \boxed{1520 \text{ LF}}$$



Computations

Project: CCRT

Location: Yarmouth, MA

Calculated by: RWP

Checked by:

Title

Project # 09794

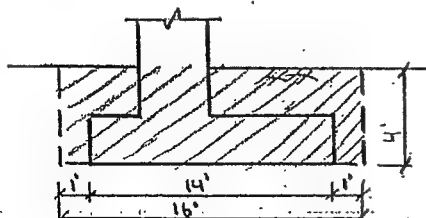
Sheet of

Date: 5/1/07

Date:

ABUTMENT COSTS -

BRIDGE EXCAVATION -



$$\text{VOLUME} = 16' \times 22' \times 4' \times \frac{1}{2} \times 2 = \underline{\underline{110.5 \text{ CY}}}$$

$$\text{FROM MHD BRIDGE MANUAL} = \$20/\text{CY}$$

$$\text{TOTAL} = 105 \text{ CY} \times \$20/\text{CY} = \boxed{\$2100}$$

GRAVEL BORROW -

$$7' \text{ WIDE} \times 20' \text{ HIGH} \times 20' \text{ LONG} \times \frac{1}{2} \times 2 = \underline{\underline{208 \text{ CY}}}$$

$$\text{FROM MHD BRIDGE MANUAL} = \$25/\text{CY}$$

$$\text{TOTAL} = 208 \text{ CY} \times \$25/\text{CY} = \boxed{\$5200}$$

BITUMENOUS DAMPROOFING -

$$20' \text{ WIDE} \times 20' \text{ LONG} \times \frac{1}{4} \times 2 = 89 \text{ SY}$$

$$\text{FROM MHD BRIDGE MANUAL} = \$11/\text{SY}$$

$$\text{TOTAL} = 89 \times 11 = \boxed{\$1000}$$

Project: CCRT

Location: Yarmouth, MA

Calculated by: RUP

Checked by:

Title

Project # 09794

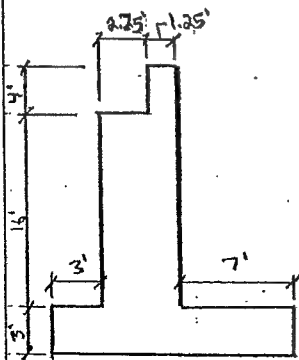
Sheet of

Date: 5/1/07

Date:

ABUTMENT COSTS -

CLASS A. CONCRETE - (SAY 20' WIDE ABUTMENTS)



$$\text{FIG. } 14' \times 3' \times 20' \text{ LONG} \times \frac{1}{27} \times 2 = 63 \text{ CY}$$

$$\text{STEM. } 4' \times 16' \times 20' \times \frac{1}{27} \times 2 = 95 \text{ CY}$$

$$\text{BACKWALL. } 4' \times 1.25' \times 20' \times \frac{1}{27} \times 2 = 8 \text{ CY}$$

$$\text{TOTAL} = 166 \text{ CY}$$

FROM MHD BRIDGE MANUAL = \$600/CY

$$\text{TOTAL} = \$600 \times 166$$

$$= \$100,000$$

STEEL REINFORCEMENT -

$$\text{SAY } 150 \#/\text{CY} \quad 150 \#/\text{CY} \times 166 \text{ CY} = 24900 \#$$

FROM MHD BRIDGE MANUAL → REBAR = \$1.50/#

$$\text{TOTAL} = \$1.50/\# \times 24900 \# = \$37350$$

BEARING PADS -

SAY \$10000 (BASIC ASSUMPTION)

$$= \$10000$$

GRAND TOTAL

$$2100 + 5200 + 1000 + 100000 + 37350 + 10000 = \$156000.00$$



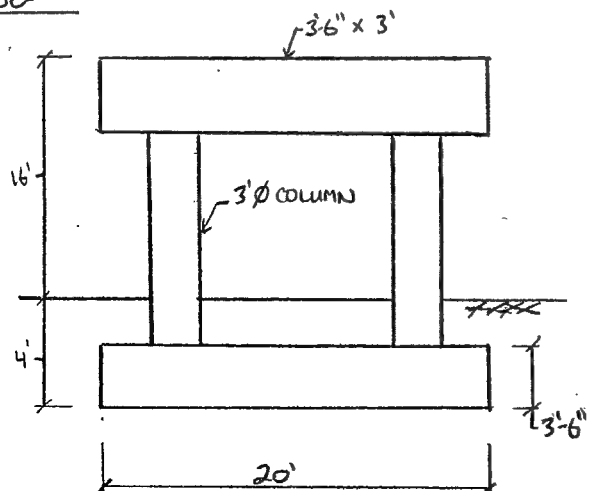
Computations

Project: CCRT
 Location: Yarmouth, MA
 Calculated by: RWP
 Checked by:
 Title

Project # 09794
 Sheet of
 Date: 5/1/07
 Date:

INTERMEDIATE PIER

CONC



$$\begin{aligned} \text{CAP} &= 3.5' \times 3' \times 20' &= 210 \text{ CF} \\ \text{COL} &= \pi \times (1.5')^2 \times 13' \times 2 \text{ COL.} &= 184 \text{ CF} \\ \text{BASE} &= 20' \text{ LONG} \times 3.5' \times 8' \text{ WIDE} &= 560 \text{ CF} \end{aligned}$$

$$\text{TOTAL} = 954 \text{ CF}$$

$$= \underline{\underline{36 \text{ CY}}}$$

$$36 \text{ CY} \times \$600/\text{CY}$$

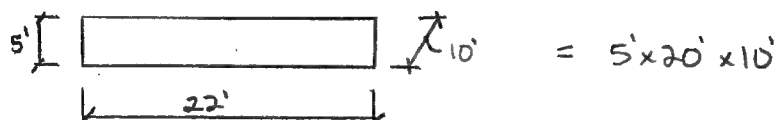
$$= \$21600$$

REBAR

$$36 \text{ CY} \times 200 \#/\text{CY} = 7200 \# \times \$1.5/\#$$

$$= \$10800$$

STRUCTURAL EXCAV.



$$= 1000 \text{ CF}$$

$$= \underline{\underline{38 \text{ CY}}}$$

$$38 \text{ CY} \times \$20/\text{CY} = \$760$$

$$\text{GRAND TOTAL} = [\$21600 + \$10800 + \$760] \times 1.10 \text{ (CONTINGENCY)}$$

$$= \$36500$$



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Precast Conc. Beam Estimate - Willow Street		

Precast Concrete Beam - Preliminary Design

Geometry

Span (ft) = 80 (Total span is 160ft, with (2) equal clear spans)
Width (ft) = 16

Cost Estimate:

Precast Beam Cost (\$/lb) = \$375.00 (Based on 2005 MHD Bridge Manual 14 of 24 and increased for inflation and current prices)

LF Beam = 640 (Assumes 4 beams will be needed for each of the (2) spans)

Cost = \$240,000

Concrete Cost (\$/yd) = \$700.00 (Based on 2005 MHD Bridge Manual 21 of 24 and increased for inflation and current prices)

Cubic Yards = 13

Cost = \$9,333

Reinf. Steel Cost (\$/lb) = \$1.50 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

lbs = 2000 (Assume 150lbs per cubic yard)

Cost = \$3,000

Membrane WP (\$/SY) = \$125.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

Area (SY) = 284 (Doubled to account for (2) 80ft spans)

Cost = \$35,556

Binder Course (\$/Ton) = \$200.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)

Tons = 24 (Doubled to account for (2) 80ft spans)

Cost = \$4,800

Pavement (\$/Ton) = \$150.00 (Based on 2005 MHD Bridge Manual costs and increased for scale and remote location)

Tons = 24 (Doubled to account for (2) 80ft spans)

Cost = \$3,600

Railing Cost (\$/ft) = \$150.00 (Based on 2005 MHD Bridge Manual costs)

LF Railing = 320 (Doubled to account for (2) 80ft spans)

Cost = \$48,000

HDPE Railing Cost (\$/ft) = \$35.00 (Based on Shining Sea Bikepath costs)

LF Railing = 1520 (Based on 380ft approach ramps on both sides of bridge)

Cost = \$53,200

Gravel Borrow (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)

CY = 15510 (Based on 380ft approach ramps on both sides of bridge)

Cost = \$310,200

New Abutments (\$) = \$156,000 (See hand calcs)

New Pier (\$) = \$36,500 (See hand calcs)

Traffic Management (\$) = \$50,000

Railroad Flagging (\$) = \$100,000

Mob Demob (\$) = \$20,000

Subtotal = \$1,070,189

Contingency = 20.0%

Total = \$1,284,227

Say = \$1,285,000



Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Prefab Steel Truss Estimate - Willow Street		

Prefab Steel Truss - Preliminary Design

Geometry

Span (ft)= 80 (Total span is 160ft, with (2) equal clear spans)
Width (ft)= 16

Cost Estimate:

Prefab Truss Cost (\$/LF)= \$1,300.00 (Based on information from Contech Bridge)
LF = 160 (Designed and delivered to site, doubled to account for (2) 80ft spans)
\$208,000

Truss Install Cost (\$/SF)= \$40.00 (Based on information from Contech Bridge)
SF = 2560 (Designed and delivered to site, doubled to account for (2) 80ft spans)
\$102,400

Railing Cost (\$/ft) = \$150.00 (Based on 2005 MHD Bridge Manual costs)
LF Railing = 320 (Doubled to account for (2) 80ft spans)
Cost = \$48,000

HDPE Railing Cost (\$/ft) = \$35.00 (Based on Shining Sea Bikepath costs)
LF Railing = 1520 (Based on 380ft approach ramps on both sides of bridge)
Cost = \$53,200

Gravel Borrow (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 15510 (Based on 380ft approach ramps on both sides of bridge)
Cost = \$310,200

New Abutments (\$) = \$156,000 (See hand calcs)

New Pier (\$) = \$36,500 (See hand calcs)

Traffic Management (\$) = \$50,000

Railroad Flagging (\$) = \$80,000 (20% less than non-prefab options to reflect shorter construction time)

Mob Demob (\$) = \$10,000 (Only 50% of other superstructure options, truss install costs are accounted for elsewhere)

Subtotal = \$1,054,300
Contingency= 20.0%
Total = \$1,265,160

Say = \$1,266,000



4021 Gault Avenue South
Fort Payne, AL 35967
(256) 845-0154
(800) 749-7515
Fax: (256) 845-9750
www.steadfastbridge.com

DATE: August 22, 2006
TO: VHB
ATTN: PETER CHIU
PHONE: 401-272-8100
FAX: 401-273-9694
RE: CAPE COD BIKE PATH BRIDGE

We are pleased to quote you a price on the Continental Bridge described below. The floor will be a 22 gage galvanized composite floor deck. Reinforcing steel and pouring of the lightweight concrete shall be by the owner or contractor. This bridge will be fabricated from A588 Weathering Steel. This will provide a "maintenance free" bridge. All Continental Bridges carry a 10 year limited warranty. Shop drawings signed and sealed by a Professional Engineer registered in the State of Massachusetts will be provided.

Location: YARMOUTH, MA

Bridge Type:	Connector
Width in feet	14'-0"
Span in feet	80'-0"
Type steel	A588 WX
Type floor	CONCRETE
Floor thickness	5"
Field splice	YES
Number of pieces	4
Dead Load PSF	70
Live Load PSF	85
Vehicle Load LBS.	20,000
Design stresses	AASHTO
Lifting Weight LBS.	39368.4
Vert. abutment load KIPS	86.8
Horiz. abutment load KIPS	7.7
Truss height in feet	5.5
Interior panel points	12
Toe plates	NO
Railing height	54"
Maximum rail openings	4"

SAY \$90,000/80 LF
= \$1125/LF

FOR 14' WIDE TRUSS

\$1125/LF x (16/14)
= \$1286/LF

SAY \$1300/LF

GRUP, MOBIL, etc
5%

Bridge cost delivered

\$ 88,025.00 x 1.05 = \$ 92,426.25

Delivery: 12 to 14 weeks (delivery schedule subject to backlog at time of drawing approval).
Bridge will be delivered to nearest location easily accessible to over-the-road trucks.
Teflon slip pads and setting plates shipped with bridge.
Anchor bolts, sales tax, unloading, erection, supports, and abutment designs not included.
Terms: 1/3 down, balance 20 days after delivery, pending credit approval.
This quote is valid for 90 days. Please call if you have any questions (800-749-7515).

Scott Dempsey
Estimator

Accepted By: _____
Title / Date: _____





Computations

Project	CCRT	Project #	09794
Location	Yarmouth, MA	Sheet	
Calculated By	RWP	Date	5/1/2007
Checked By		Date	
Title	Prefab Timber Truss Estimate - Willow Street		

Prefab Timber Truss - Preliminary Design

Geometry

Span (ft) = 80 (Total span is 160ft, with (2) equal clear spans)
Width (ft) = 16 (Curb to curb)

Cost Estimate:

Prefab Truss Cost (\$/SF) = \$90.00 (Based on information from Western Wood Structures)
SF = 2560 (Designed and delivered to site, doubled to account for (2) 80ft spans)
Cost = \$230,400

Truss Install Cost (\$/SF) = \$40.00 (Based on information from Contech Bridge)
SF = 2560 (Designed and delivered to site, doubled to account for (2) 80ft spans)
Cost = \$102,400

Railing Cost (\$/ft) = \$150.00 (Based on 2005 MHD Bridge Manual costs)
LF Railing = 320 (Doubled to account for (2) 80ft spans)
Cost = \$48,000

HDPE Railing Cost (\$/ft) = \$35.00 (Based on Shining Sea Bikepath costs)
LF Railing = 1520 (Based on 380ft approach ramps on both sides of bridge)
Cost = \$53,200

Gravel Borrow (\$/CY) = \$20.00 (Based on 2005 MHD Bridge Manual costs and increased for inflation)
CY = 15510 (Based on 380ft approach ramps on both sides of bridge)
Cost = \$310,200

New Abutments (\$) = \$156,000 (See hand calcs)

New Pier (\$) = \$36,500 (See hand calcs)

Traffic Management (\$) = \$50,000

Railroad Flagging (\$) = \$80,000 (20% less than non-prefab options to reflect shorter construction time)

Mob Demob (\$) = \$10,000 (Only 50% of other superstructure options, truss install costs are accounted for elsewhere)

Subtotal = \$1,076,700
Contingency = 20.0%
Total = \$1,292,040

Say = \$1,293,000

Collins, Andrew

From: Hazen Hyland [hazenh@westernwoodstructures.com]
Sent: Tuesday, September 12, 2006 12:15 PM
To: Collins, Andrew
Subject: RE:

Andy,

Yes, we offer bowstring truss bridges in spans less than 100'. 65' is an adequate length for a bowstring truss bridge. On a 100' pony truss or bowstring truss bridge, figure installation of 8-10 days with 4 bodies. I'm just shooting from the hip, as it could go faster depending on the crew. Basically you build the bridge on the ground, then make one pick with a crane.

Wood vs. Steel...obviously the natural look of wood usually fits well in any surrounding environment. All our products are customer, as in we can make your bridge length precisely what you need. If you want a unique looking rail, we can work with you to attain this. If anything happens to your bridge in the first year, we will fix it. Our 1 year warranty is offered because any bridge problem will usually occur in the first year.

Installation costs: Approximately 40-\$45 per square foot, and this doesn't include the crane cost. I'd have to first research what crane costs run in your neck of the woods.

IF WESTERNWOOD STRUCT. INSTALLS IT (PREMIUM)

Good questions,

FOR WESTFIELD BIKE PATH CALCULATED @ \$53/sf

Hazen Hyland
Western Wood Structures, Inc. - est. 1969
20675 SW 105th Ave
PO Box 130
Tualatin, OR 97062
www.westernwoodstructures.com

(800) 547-5411 phone
(503) 692-6434 fax

-----Original Message-----

From: Collins, Andrew [mailto:ACollins@VHB.com]
Sent: Tuesday, September 12, 2006 8:36 AM
To: Hazen Hyland
Subject: RE:

This is a huge help, thanks a ton.

Do you have the bow string option for spans less than 100'? Also, about how long does it take the contractor to assemble the truss and about how many workers does it require? If its not too much trouble would you send me your estimate for installation?

The timber option seems to be competitive with the steel truss option. If you can offer any additional talking points as to why timber is advantageous over steel I'd appreciate it.

Thanks very much,
Andy

From: Hazen Hyland [mailto:hazenh@westernwoodstructures.com]
Sent: Tuesday, September 12, 2006 11:17 AM
To: Collins; Andrew
Subject:

Andy,

I've included some details of previous projects in the attachments above.

Budgetary per square foot prices for a pony truss Timber Bridge.

14' x 65' - \$86 to \$88 } FOR ESTIMATING SAY $\$90/\text{SF} \cdot 90 \times 14' = \1260
14' x 100' - \$84 to \$86 }

If you need an abutment design (I realize you're trying to reuse the existing abutments), this is something we offer. Cost for abutment design (regardless of bridge length): \$1,700.

Above prices include design, supply, and delivery of all bridge materials. Because materials are predrilled and precut, the bridge is ready for installation upon arrival.

Another option, and I'm just throwing it out there, is a bowstring truss bridge. There's more height to this bridge, something you maybe trying to avoid, but the arch makes the bridge somewhat distinguishable). The PSF cost of a bowstring truss bridge 100' long is the same price as a pony truss bridge.

Since you've been on our website, you've probably already filtered out the bridge types you are not interested in. However if you are interested in seeing photos of a bowstring truss bridge, click on the "Teufel Nursery Bridge" picture on our home page (it's one of the rotating pictures).

If you need budgetary installation figures, we can provide them.

Thank you Andy,

Hazen Hyland
Western Wood Structures, Inc. - est. 1969
20675 SW 105th Ave
PO Box 130
Tualatin, OR 97062
www.westernwoodstructures.com

(800) 547 - 5411 phone
(503) 692 - 6434 fax

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Vanasse Hangen Brustlin, Inc. 101 Walnut St
Watertown, MA 02472
617-924-1770

Collins, Andrew

From: Hazen Hyland [hazenh@westernwoodstructures.com]
Sent: Tuesday, September 12, 2006 11:17 AM
To: Collins, Andrew
Attachments: pony truss bridge.pdf; bowstring truss bridge.pdf

Andy,

I've included some details of previous projects in the attachments above.

Budgetary per square foot prices for a pony truss Timber Bridge.

14' x 65' - \$86 to \$88
14' x 100' - \$84 to \$86

If you need an abutment design (I realize you're trying to reuse the existing abutments), this is something we offer. Cost for abutment design (regardless of bridge length): \$1,700.

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Thank you Andy,

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20675 SW 105th Ave
PO Box 130
Tualatin, OR 97062
www.westernwoodstructures.com

(800) 547 - 5411 phone
(503) 692 - 6434 fax

Transportation
Land Development
Environmental
Services



Vanasse Hangen Brustlin, Inc.

101 Walnut Street
Post Office Box 9151
Watertown
Massachusetts 02471-9151
617.924.1770
FAX 617.924.2286

Phone
Notes

Person Contacted:

Title:

Company: *Western Wood*

Telephone No.:

FAX No.:

VHB Rep:

Andy Collins

VHB Project No.:

09794

Project Name:

Type of Call:

Date and Time:

10,000 lb Vehicle

14 x 65

14 x 100

}

*He will provide estimate for both spans
and both truss and girder*

Truss Style

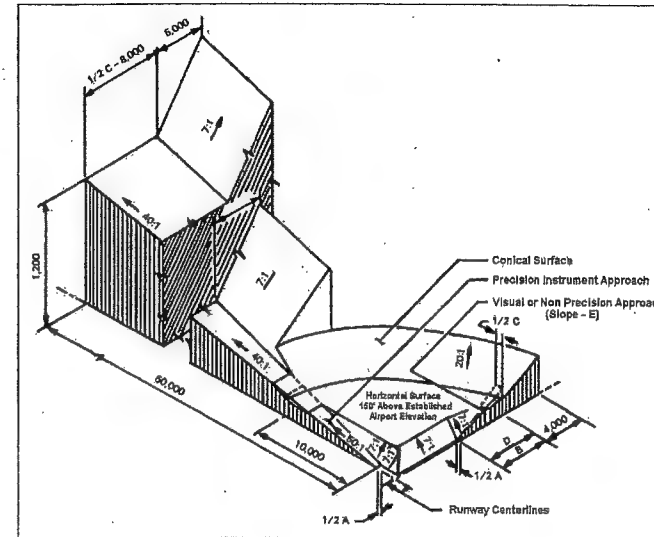
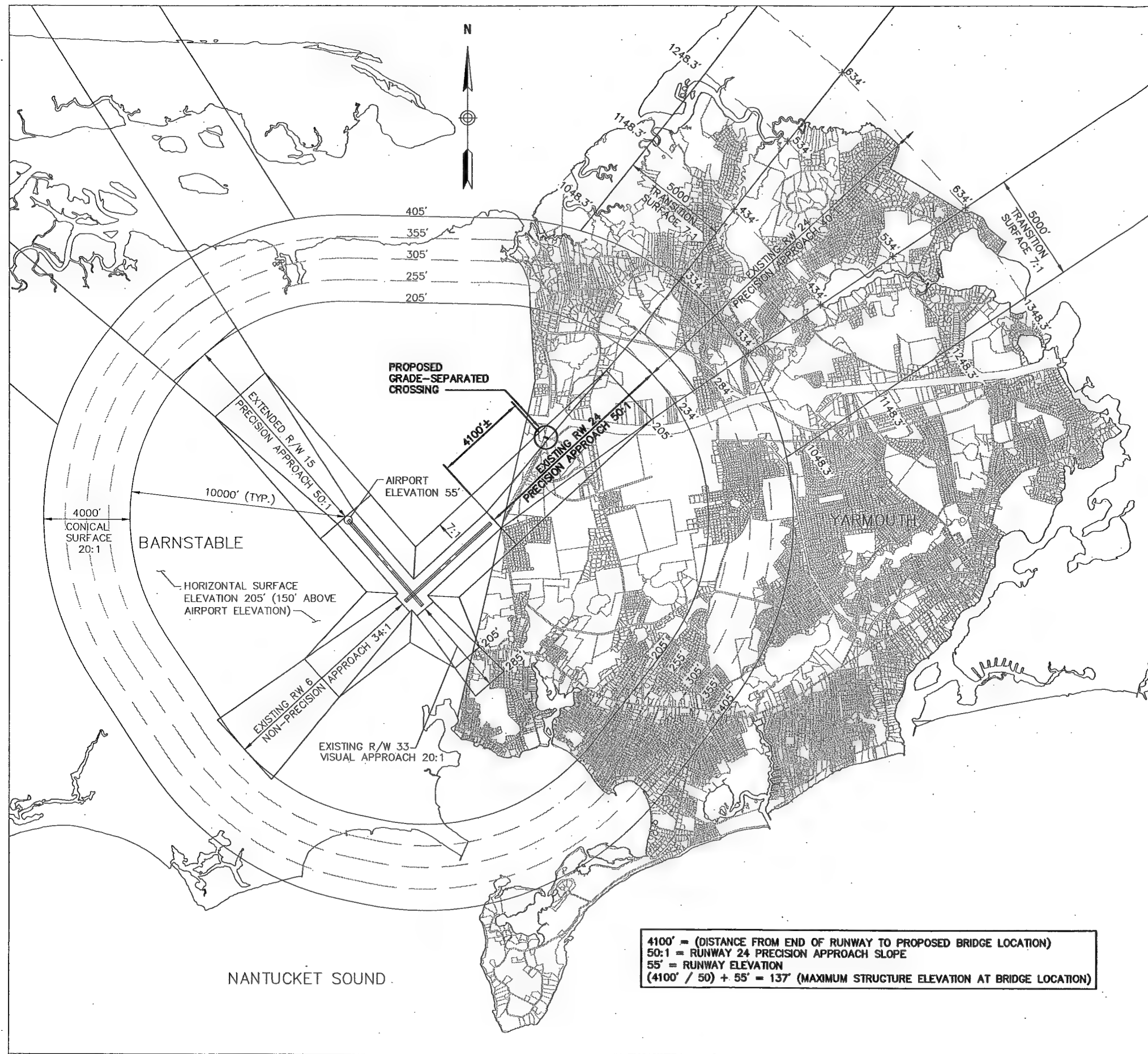
or

Girder Style

}

*For 65' They can do both truss
and girder*

*like span → 50 years conservatively, but most likely
longer, 60-70 years*



3-D DIAGRAM OF FAR PART 77 SURFACES

- KEY:**
- CEMETERY
 - CONSERVATION
 - CONSERVATION & RECREATION
 - LAND BANK
 - LIBRARY
 - MUNICIPAL
 - MUNICIPAL & RECREATION
 - RECREATION
 - SCHOOL
 - WATER

- NOTES:**
1. HIGHEST RUNWAY END IS AT ELEVATION 55', FAR PART 77 SURFACES ARE TAKEN FROM THIS ELEVATION.
 2. REFERENCE SYSTEM & DATUM - STATE PLANE NAD 27 ZONE - MASSACHUSETTS MAINLAND, VERTICAL DATUM NGVD 29.



FAR Part 77 Surfaces Review
Barnstable Municipal Airport

Yarmouth Public Lands
Town of Yarmouth

VHB Vanasse Hangen Brustlin, Inc.
Transportation Land Development Environmental Services
101 Walnut Street P.O. Box 9151
Watertown, MA 02471 617 924 1770 FAX 617 924 2286

DESIGNED BY: RWP
DRAWN BY: RWP
CHECKED BY: TWJ

DATE: 05/10/07
SCALE: 1"=2500'
SHEET OF: 1 OF 1

JOB NO. 09794.00

4100' = (DISTANCE FROM END OF RUNWAY TO PROPOSED BRIDGE LOCATION)
50:1 = RUNWAY 24 PRECISION APPROACH SLOPE
55' = RUNWAY ELEVATION
(4100' / 50) + 55' = 137' (MAXIMUM STRUCTURE ELEVATION AT BRIDGE LOCATION)

Appendix 2

Chapter 91 Licenses

Fragment of New York

Fragment of New York

Fragment of New York

Fragment of New York

Fragment of New York

... Commonwealth, of the further sale of
... deemed to be just and equitable therefor
... so construed as to impair the legal rights of any person.
... the same, and the accompanying plan, are recorded, within one year
... Deeds for the ... District of the County

In Witness Whereof,

... said Board of Harbor and Land

set their hands this

James M. ...

day of

in the year eighteen hundred and eighty *SEVEN*.

James M. ...
...
...

Harbor and
Land
Commissioners.

.....

Notary Public

COMMONWEALTH OF MASSACHUSETTS.

...

...

DENNIS

YARMOUTH

The Commonwealth of Massachusetts



Be it enacted by the Senate and House of Representatives in Council, January 1, 1888.

That the Old Colony Railroad Company, of Suffolk _____, and Commonwealth

do hereby apply to the Board of Harbor and Land Commissioners for license to
use the front of the abutments of its bridge over Bass
River, in the towns of Dennis and Yarmouth,

and whereas due notice of said application, and of the
time and place for a hearing thereon, has been given, as required by law, to the
_____ of the towns _____

and Yarmouth,

That, and I, the said Board, do hereby certify that the said application, hereby, subject to the approval of the Governor and Council, authorizes
the said Old Colony Railroad Company _____

to use the front of the abutments of its bridge
over Bass River, and of all land which may be so lawfully applicable thereto, in

the towns of Dennis and Yarmouth, in con-
formity with the provisions of the laws of the Commonwealth, which laws

do hereby authorize the Board of Harbor and Land Commissioners to
grant the same, subject to the laws of the Commonwealth.

The license is granted subject to the laws of the Commonwealth.

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The First of said 1875

and be in the office of said Board, numbered 1 1 1 and a duplicate of said
said certificate and license, and it is to be returned as at a part thereof.

The amount of information supplied by the said body, and the said, shall be returned
to said Board, and compensation therefor shall be made to the said

Board, and

and wages, by paying into the treasury of the Commonwealth

costs for each copy, and as required, being the amount
to be paid by said Board, the said to be covered as a compensation fund for the Board of
said

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[Faint, mostly illegible text at the top of the page, possibly a preamble or introductory paragraph.]

In Witness Whereof, said Board of Harbor and Land Commissioners have hereunto set their hands and seals, this _____ day of April, _____.

Wm. F. Murray
Geo. E. Smith
Chas. C. Pease

}
} *Harbor and*
} *Land*
} *Commissioners.*

THE COMMONWEALTH OF MASSACHUSETTS.

Boston, Apr 11/13

Attest by the Treasurer and Clerk

W. F. Smith
Executive Secretary

[Faint circular stamp or seal, possibly a date or official mark.]

[Handwritten signature]
Mark of Board



Appendix 3

Local Wetlands By-Laws

TOWN OF DENNIS
CONSERVATION COMMISSION
RULES & REGULATIONS
Effective August 19th, 2005

<u>SECTION</u>	<u>PAGE</u>
SECTION 1: DEFINITIONS	1 - 9
SECTION 2: PERFORMANCE STANDARDS	10 - 11
SECTION 3: RULES AND REGULATIONS GOVERNING RAMPS, DOCKS, PIERS, FLOATS, AND BOARDWALKS	12 - 13
SECTION 4: VARIANCE	13
SECTION 5: GENERAL POLICIES	14 - 15
APPENDIX:	
A. 50(FIFTY) FOOT NO DISTURB ZONE FROM A WETLAND RESOURCE	
B. NEW OR EXPANDED DOCK FACILITIES	
C. SEPTIC SYSTEM LEACHING FACILITIES PROHIBITION WITHIN 100 FEET OF WETLAND RESOURCE AREAS	

**TOWN OF DENNIS
CONSERVATION COMMISSION
RULES & REGULATIONS
(Effective Date August 19, 2005)**

The following are the Dennis Conservation Commission's Rules and Regulations which are to be used in conjunction with Mass. General Laws Chapter 131, Section 40 and Dennis Wetlands Bylaw.

SECTION 1: DEFINITIONS

The following definitions shall apply as regulations to the Town of Dennis Wetlands Bylaw as provided in Section 9. Unless otherwise defined here, definitions found in 310 CMR 10.00 are incorporated as definitions to the Town of Dennis Wetlands Bylaw as provided in Sections 7 & 9.

ABANDONED: a structure or land use within a resource area or buffer zone that has fallen into a state of disrepair and/or loss of use due to neglect and/or damage and has not been repaired or replaced for a period greater than five years.

ACTIVITY: All activities set forth in the Bylaw, Section 2, including altering, removing, filling, dredging or building upon.

AESTHETICS/WETLAND SCENIC VIEWS - The landscape setting/viewshed available to the public over, across or within wetland resource areas and their buffer zones.

ADVERSE EFFECT: A greater than negligible change in the resource area or one of its characteristics, functions or factors that diminishes the value of the resource area to one or more of the specified interests of the Town of Dennis Wetlands Protection Bylaw and Regulations, as determined by the Commission. "Negligible" means small enough to be disregarded and shall be defined in relation to the wetland resource areas impacted.

AGRICULTURE: Any work which produces food or other products for commerce or subsistence which occurs in, on, or within the Buffer Zone to a resource area or which is directly or indirectly dependent upon wetlands values for proper agricultural functions, such as prevention of pollution or maintenance of adequate water flow for irrigation. Agriculture includes, but is not limited to the growing of crops, including cranberries, and the raising of livestock.

ALTER: To change the condition of areas within jurisdiction (as listed in Section 2 of the Town of Dennis Wetlands Bylaw) of the Conservation Commission. Activities presumed to alter these areas include, but are not limited to the following:

- a. Removal, excavation or dredging of soil, sand, gravel or aggregate materials of any kind
- b. Changing of pre-existing drainage characteristics, flushing characteristics, salinity distribution, sedimentation patterns, flow patterns, or flood retention characteristics
- c. Drainage or other disturbance of water level or water table
- d. Dumping, discharging, or filling with any material
- e. Placing of fill or brush or removal of material
- f. Erections of buildings or structures of any kind; installation of piles except in accordance with pier maintenance conditions of the Commission
- g. Destruction of any vegetation. (Reference Section 5: General Policies 3A)
- h. Cutting vegetation (Reference Section 5: General Policies 3A)
- i. Changing water temperature, biological oxygen demand, or other physical or chemical characteristics of water
- j. Any activities, changes or work which pollute in any way any body of water or ground water
- k. Any activities which change the aesthetics of a resource area in a significant manner and for more than a temporary period

AQUACULTURE: The growing, raising, breeding, storing or producing of specified freshwater and marine organisms at specified locations for private, commercial, municipal or scientific purposes as approved by appropriate agencies. Organisms in aquacultural use include, but are not limited to: shellfish, such as oysters, quahogs, clams, mussels, scallops, crustaceans, lobsters and crabs; finfish such as flounder, trout, eel, herring, salmon, smelt and bass; amphibians, such as frogs; reptiles, such as turtles; seaweeds, such as Irish moss and dulse; edible freshwater plants, such as watercress; and plankton grown as a food source for other organisms.

BOARDWALK: Wooden planks or other material used for access over any wetland resource area or buffer zones.

BORDERING VEGETATED WETLAND: Bordering vegetated wetlands are freshwater wetlands, which border on creeks, rivers, streams, ponds, lakes and saltmarshes. The types of freshwater wetlands are wet meadows, marshes, swamps and bogs. Bordering vegetated wetlands are areas where the soils are saturated and/or inundated such that they support a predominance of wetland indicator plants. The ground and surface water regime and the vegetational community which occur in each type of freshwater wetland are as specified in MGLCh131s40, 310CMR10.55(2) and in the U.S. Fish and Wildlife Service National List of Plant Species that Occur in Wetlands: Massachusetts 1988, or other approved source within indicator categories as obligate wetland, facultative wetland and facultative.

BUFFER ZONE: Land within 100 feet of any wetland resource area. No buffer zones exist adjacent to isolated lands subject to flooding or land subject to coastal storm flowage.

COASTAL BANK: A seaward face or elevated land form, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action, land subject to coastal storm flowage or other coastal wetland. The slope of the bank must be greater than 10% (10:1) and serve to contain storm flowage, rather than being inundated by it, or function as a sediment source. A bank may be partially or totally vegetated, or it may be comprised of exposed soil, gravel, stone or sand. A bank may or may not contribute sediment to coastal dunes, beaches and/or to the littoral drift system. A bank may be significant as a major source of sediment, as a vertical buffer, for wildlife habitat and/or for aesthetics.

TOP OF COASTAL BANK - The first significant break in slope beyond the 100 year storm elevation (determined by FEMA) on a seaward face or elevated land form, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action, land subject to coastal storm flowage, or other coastal wetland.

COASTAL DUNE: Any natural hill, mound, ridge or field (or interactive assemblage or grouping of ridges, hills or mounds) composed of sediment, any portion or component of which touches upon and exchanges sediment with and is landward of a coastal beach deposited by wind action and/or storm overwash. Coastal dune shall also mean sediment deposited by artificial means. All coastal dunes are considered significant to the interests of the Town of Dennis Wetlands Protection Bylaw including storm damage prevention, prevention of flooding, prevention of pollution, groundwater supply, sediment and erosion control, wildlife habitat, recreation and aesthetics unless determined by the Commission, based on a preponderance of evidence from a credible source, not to be so.

COASTAL WETLAND: Any bank; beach; dune; barrier beach; ocean; bay; estuary; tidally dominated river, stream or creek; marsh; swamp; meadow; flat or other lowland subject to tidal action or coastal storm flowage from the ocean, bay or an estuary.

COMMERCIAL SPACE: Land area and/or structures within resource areas or buffer zones presently and primarily used in a manner related to, and customarily and necessarily used in commerce, work area intended for commerce or any area/space other than a single family or multi family residential unit the purpose of which is to generate income (exclusive of farm income).

CUMULATIVE EFFECTS: Activities regulated under this Bylaw, which may be individually minor, but when considered in relation to other past, present or reasonably anticipated future activities in a given area may be significant in the aggregate.

DEPTH TO GROUNDWATER(groundwater/water table elevations): The perpendicular distance between the upper edge of the land surface and evidence of a free standing water level as determined by:

- a.) direct observation of highest groundwater elevation (including seasonal and perched groundwater);
- b) direct observation of mottling (redoximorphic features); and
- c) by calculation using the USGS Frimpter high groundwater adjustment method.

The actual recorded depth to groundwater shall be the highest groundwater elevation determined by a, b, and c (based on NGVD datum).

DOCK/PIER FACILITIES: A structure extending out from shore to the water to serve as a landing place or a recreation facility in itself. A dock/pier facility is comprised of, but not limited to, a boardwalk, ramp and floats.

- a) Boardwalk: an elevated structure that crosses or extends in a resource area
- b) Floats: buoyant structures which serve as a loading place or as a recreational facility in itself
- c) Ramp: a structure connecting a boardwalk to a float or grade in the absence of a boardwalk.

ENVIRONMENTALLY SENSITIVE AREAS: Land area (whether developed or not) as defined within the jurisdiction of the Conservation Commission in the Town of Dennis Wetlands Protection Bylaw Section 2; land containing subsurface water which is six feet (6 ft.) or less below natural ground surface elevation; existing or known future drinking water supplies, and/or terrestrial and/or aquatic plant/animal life habitats or threatened or endangered species habitats when certified by the Dennis Department of Natural Resources and/or an agency that specializes in such taxonomy and/or environmental science.

EROSION AND SEDIMENTATION CONTROL:

Erosion Control: The ability of the wetland resource area and its buffer zone to buffer forces or processes which would threaten or cause to be threatened the stability of landforms and the soil and/or vegetation associated with wetlands and adjoining land areas, in particular. Erosion can be caused by a wearing away of the surface soil, by undermining the interior portion of the landform and/or by altering vegetative cover.

Sedimentation Control: The ability of wetland resource areas and their buffer zones to settle out sediments and other air and/or waterborne material by reducing and/or slowing wind and water flow by passing it through vegetation or by diffusing flow and reducing velocity.

FLOOD CONTROL CHARACTERISTICS AND FUNCTIONS: The ability of wetland resource areas to absorb, buffer, provide a vertical barrier to, store and/or slowly release flood waters to minimize peak flood levels and coastal storm damage. Flooding can be caused by precipitation, rising water table and/or coastal storm events.

FRESHWATER WETLAND: Any inland bank, marsh, wet meadow, bog, swamp, creek, river, stream, pond or lake, isolated land subject to flooding, isolated vegetated wetland, land subject to flooding or vernal pool.

GRANDFATHERING/PRE-EXISTING USE: allows for the use and normal maintenance of any structure or alteration of land, within wetland resource areas and their buffers, existing at the time of enactment of MGLCh131s40 (effective date 1972) and/or the Town of Dennis Wetlands Protection Bylaw (effective date 1975) or subsequent revisions. The activities may be continued subject to the following:

- Existing structures, uses and/or alterations may not be extended and/or modified unless such extension or alteration is permitted by a finding of the Commission that such alteration shall have no adverse effect/significant adverse effect on the resource areas relative to the interests protected by the Town of Dennis Wetlands Protection Bylaw.
- Existing structures, uses and/or alterations which have been abandoned or discontinued for five years or more shall not be reestablished and any future use shall conform with then-current provisions of the Town of Dennis Wetlands Protection Bylaw, as appropriate.
- Maintenance and/or repair to existing onsite sewage disposal systems and drinking water supply wells are excluded from this definition.

GROUNDWATER: All subsurface water contained within the zone of saturation and/or where it has occurred at its highest point as determined by the methodology described in the definition for DEPTH TO GROUNDWATER.

HABITABLE SPACE: Space in a structure for living, sleeping, eating or cooking. Bathrooms, toilet compartments, closets, halls, storage or utility space and similar areas are not considered habitable space (780CMR Ma. State Building Code).

INLAND BANK: The elevated portion of the land surface, which normally abuts and confines a water body. It occurs between a water body and a vegetated bordering wetland and adjacent floodplain, or in the absence of these, it occurs between a water body and upland. A bank may be partially or totally vegetated or it may be comprised of exposed soil, gravel or stone.

INVASIVE PLANT SPECIES: Invasive plants are best defined as plants introduced from somewhere else. A typical harmful invasive plant grows and matures rapidly, spreads quickly, can flower and/or set seed all season, has no known diseases or pests to control it and is difficult to remove or control. Invasives, typically non-native species often blanket large areas thereby reducing the biodiversity of natural areas. (Reference "The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts dated 3/14/03 or subsequent updates as available in Dennis DNR office).

ISOLATED VEGETATED WETLAND: Any area greater than 500 square feet where surface or ground water, or ice, is at or near the surface of the ground and which supports a plant community (cover) comprised of 50 percent or greater of wetland species, or which in the judgment of the Commission supports a significant community of wetland vegetation, and is characterized by hydric soils and/or exhibits hydrologic characteristics and does not border or touch upon any wetland resource area.

MAINTAIN/MAINTENANCE: To keep in its lawfully existing state, without expansion, and preserve from failure, decline or disrepair.

NOTICE OF INTENT: The form filed by any person intending to remove, fill, dredge or alter an area subject to protection and jurisdiction under the Town of Dennis Wetlands Protection Bylaw.

ORDER OF CONDITIONS: The document issued by the Conservation Commission containing conditions which regulate or prohibit an activity.

PERSON: Any individual, group of individuals, associations, partnership, corporation, company, business organization, trust, estate, the Commonwealth or political subdivision thereof to the extent subject to town Bylaws, administrative agency, public or quasi-public corporation or body, the town of Dennis, and any other legal entity, its legal representatives, agents or assigns.

PRIVATE WATER SUPPLY: Any source or volume of surface or ground water demonstrated to be in private use for drinking water and/or irrigation purposes or shown to have potential for private use, including ground or surface water in the zone of contribution around a private well. The significance of private water supply interests shall be evaluated based on its actual and/or intended use.

PUBLIC RECREATIONAL INTERESTS: Use/access by the public including, but are not limited to, bathing, boating, bird watching, hiking, hunting, fishing, shellfishing, horseback riding, etc. of wetland resource areas and associated buffer zones that do not adversely impact wetland resource areas.

PUBLIC TRUST RIGHTS: The right of the citizens of the Commonwealth of Massachusetts to engage in fishing, including shellfishing, fowling and navigation, and access from the water and access along the shore below mean high water to, on or over trustlands to pursue these rights, in accordance with the provisions of 310 CMR 9.00 and decisions of the Massachusetts Supreme Judicial Court, and subject to other state and local regulations.

PUBLIC WATER SUPPLY: Any source or volume of surface or ground water demonstrated to be in public use or approved for water supply pursuant to M.G.L. Chapter 111, Section 160 by the Department of Environmental Protection Division of Water Supply, or demonstrated to have a potential for public use, in addition to all surface and ground water in zones of contribution.

RECREATION: Any leisure activity taking place in, on, or within the buffer zone of a resource area. Recreational activities include, but are not limited to the following: non commercial fishing, shellfishing, hunting, boating, swimming, walking, running, painting, bird watching and aesthetic enjoyment.

REQUEST FOR DETERMINATION OF APPLICABILITY: The form filed by an applicant requesting a decision by the Conservation Commission as to whether an area or work proposed falls within its jurisdiction and/or whether a Notice of Intent must be filed.

RESOURCE AREAS: Includes all freshwater and coastal wetlands.

SIGNIFICANT EFFECT: A greater than negligible change in the resource area or one of its characteristics, functions or factors that adversely impacts, or alternatively enhances, the resource area to one or more of the specified interests of the Town of Dennis Wetlands Protection Bylaw and Regulations as determined by the Conservation Commission. "Negligible" means small enough to be disregarded and shall be defined in relation to the wetland resource areas affected.

STORM DAMAGE PREVENTION: The ability of soils, vegetation and physiography to prevent damage caused by water from storms, including but not limited to: erosion and sedimentation; damage to vegetation; property or buildings; or damage caused by flooding, waterborne debris or waterborne ice.

SURFACE WATER BODY: Any area where water or ice stands or flows over the surface of the ground for at least five months of any calendar year except in times of severe, extended drought as defined in appropriate sections of 310 CMR. Drainage ditches (exclusive of fish runs and intermittent streams), and impoundment areas which hold or pass water only during or for short periods following storms; and which owing to their relationship to ground water, do not support wetland vegetation, are excluded from this definition.

TRUSTLANDS: Lands impressed with public trust rights protected by the Commonwealth, including Great Ponds and tidelands, being present and former submerged lands and tidal flats lying between the natural mean high water mark and the state limit of seaward jurisdiction. Tidelands include both flowed and filled tidelands; privately owned and publicly owned tidelands.

UNVEGETATED WETLAND RESOURCE AREAS: Coastal areas, such as flats and unvegetated intertidal areas; coastal and fresh water beaches; dunes and banks; and land subject to flooding. Also, unvegetated inland areas subject to flooding which are not defined as isolated vegetated wetlands, but which store at least ¼ acre-foot of water to an average depth of six inches at least once a year, and land areas two feet or less vertically above the high water mark of any lake or pond defined by 310 CMR10:00. This definition does not include swimming pools; artificially lined ponds or pools; wastewater lagoons or storm water runoff basins, the construction of which may be regulated, but do not themselves constitute regulated areas.

VERNAL POOL/VERNAL POOL HABITAT: An area within a wetland resource area or buffer zone that exists as a confined basin depression which, at least in most years, hold water for a minimum of two continuous months during the spring and/or summer, and is free of adult fish populations, as well as the area within 100 feet of the mean annual boundaries of such depressions. A vernal pool/vernal pool habitat may be located in or within 100 feet of wetland resource areas as defined in Section 2 of the Town of Dennis Wetlands Protection Bylaw. A vernal pool/vernal pool habitat provides essential breeding habitat, and provides other extremely important wildlife habitat functions during non-breeding seasons for a variety of amphibian species as well as for other wildlife species. Vernal pools/vernal pool habitats are defined by obligate and facultative species found within its boundaries. Obligate species include the wood frog, the spadefoot toad, the spotted salamander, the blue-spotted salamander, the Jefferson salamander, the marbled salamander and two species of fairy shrimp. Facultative species include remaining frogs, fingernail clams, amphibious snails, leeches, insect larvae and some reptiles. A vernal pool/vernal pool habitat must be documented by a qualified professional to the satisfaction of the Commission or by the Massachusetts Natural Heritage & Endangered Species Program.

WATER DEPENDENT PROJECTS OR USES: Water dependent projects or uses require direct wetlands access for their intended use and therefore can not be located out of the Area Subject to Protection Under the Bylaw. Examples include but are not limited to: docks, piers, boat landings, boathouses, marinas, stairs to beaches and boardwalks over wetland vegetation. Projects which benefit from wetlands access but which do not require it are not water dependent uses. Examples include but are not limited to: restaurants, dwellings and commercial enterprises servicing marine-related uses such as fish markets, repair facilities, storage yards and general use recreational trails.

WETLANDS REPLICATION: The creation or extension of wetland, surface water body or other resource area to compensate for the filling, loss or displacement of all or part of an existing wetland, surface water body or other resource area.

WILDLIFE (including plant and animal species) HABITAT: Resource areas and their buffer zones that provide breeding and nesting habitats, shelter, food and water to all plant and animal species dependent on wetlands for any portion of their cycles. Includes resource areas and their buffers and vernal pools/vernal pool habitat, as identified in Section 2 of the Town of Dennis Wetlands Protection Bylaw and the Town of Dennis Conservation Commission's Rules and Regulation.

WORK: All activities set forth in the Bylaw, Section 2, including altering, removing, filling, dredging or building upon.

ZONE OF CONTRIBUTION: The segment of an aquifer that contributes significant quantities of ground water to a drinking water supply well. Drinking water supply wells may be municipal drinking water supply wells, may be other public drinking water supply wells as defined by the Massachusetts Department of Environmental Protection and/or the Dennis Board of Health and may be private drinking water supply wells. Zones of Contributions for existing and potential municipal supply drinking wells are mapped at the Dennis Water District office, the MDEP Division of Water Supply and the Cape Cod Commission. Mapped locations for other public drinking water supply wells as permitted by MDEP are on file at MDEP offices in Boston and Lakeville and some may be on file at the Dennis Board of Health office. Location of private drinking water supply wells are on file at the Dennis Board of Health office, however for most private wells, their specific zone of contribution has not been defined.

SECTION 2: PERFORMANCE STANDARDS

1. When structures are permitted within 100 feet of a wetland, every effort shall be made to keep this structure as far as possible from the wetland. No activities or alterations, except water dependent projects or uses and activities as noted in Section 5 #3 and #4, may be closer than 50 feet to any wetland resource area. "Wetlands"/wetland resource area is defined by M.G.L. Chapter 131, Section 40, Dennis Wetlands Bylaws and Dennis Wetlands Regulations. Documentation shall be submitted with each Notice of Intent, in sufficient detail to show compliance with the performance standards. Documentation shall include plans stamped by a Professional Land Surveyor, a Professional Engineer, Registered Sanitarian, Architect or Landscape Architect or as deemed appropriate by the Commission.
2. No septic system leaching facilities shall be any closer than 100 feet to any wetland as defined by M.G.L. Chapter 131, Section 40 and Dennis Wetlands Bylaw.
 - a. In environmentally sensitive areas, septic systems that incorporate a retaining wall design that is exposed above ground shall be planted around the outside of the wall to prevent erosion, provide aesthetic protection and to mitigate alterations to surface runoff.
 - b. As a condition for commencing work (relating to any increase in building footprint including decks, porches and garage square footage) allowed under an Order of Conditions: Any existing septic system(s) that fall within either a resource area or the 100 foot buffer zone around said area, must be located and upgraded in accordance with the state's Title V and Town of Dennis Board of Health design performance standards and regulations, unless documented not to serve as a source of pollution to groundwaters and/or down-gradient wetland resource areas. All existing onsite septic system leaching facilities within the jurisdiction of the Conservation Commission shall be separated from highest groundwater elevation by a minimum of four or five vertical feet depending upon soil conditions in accordance with Title 5 (310CMR15.00) soils description requirements.
3. Any alteration of drainage patterns must be appropriately engineered so as not to adversely impact a wetland resource area or groundwater resources.
4. Permission will not be granted to build a solid or static structure such as a bulkhead, a sea wall or retaining wall for shoreline erosion control purposes if any bank is already stabilized by vegetation.

5. There will be no expansion of habitable space, commercial space area, or the foundation footprint of any structure or dwelling, located within the limits of a coastal beach, coastal dune, or barrier beach unless the project proponent provides a preponderance of evidence from a credible source to document that the proposed expansion will not adversely effect the volume, form or function of these wetland resource areas. Additionally, the project proponent shall demonstrate that there will be no adverse impact to any of the interests of the Town of Dennis Wetlands Protection Bylaw including but not limited to, prevention of water pollution, ground water quantity and quality and wildlife habitat.
6. Activities in any resource area, exclusive of land subject to coastal storm flowage, shall not have any adverse effect/significant effect on aesthetic values and shall not significantly change the appearance of any resource area.
7. Activities in or within 100 feet of resource areas shall not have any adverse effect/significant adverse effect on existing permitted agriculture, or existing permitted aquaculture within any wetland resource area and/or shall not have any adverse impact/significant adverse effect on the wetlands values set forth in Section 1 of this Bylaw.
8. Activities in or within 100 feet of any wetland resource area shall not have any adverse effect/significant adverse effect on: natural erosion; natural sedimentation; naturally occurring ground water, private water and public water supply, and storm damage prevention within any wetland resource area.
9. Structures and activities in or within 100 feet of a resource area shall not have any adverse effect/significant adverse effect to any wetland resource area for public recreational values, including fishing, fowling, shellfishing and boating and shall not have any adverse impact/significant effect on other wetland values identified in Section 1 of this Bylaw.
10. Structures and activities in or within 100 feet of any resource area shall not have any adverse effect/significant adverse effect on wetland dependent wildlife habitat.
11. The existing and naturally occurring topography at the time of application shall be the basis for all decisions.
12. Wetland resource area replication/compensation shall not be allowed unless the project proponent has demonstrated to the Commission's satisfaction, that there are no reasonable alternatives; that the project as proposed minimizes the amount of replication/compensation necessary; that the mitigation proposed is a minimum of a 2:1 ratio; that the mitigation proposed enhances existing wetland resources and public wetland interests, and that adequate construction and monitoring protocols are provided.

SECTION 3: RULES AND REGULATIONS GOVERNING BOARDWALKS, RAMPS, DOCKS, PIERS AND FLOATS (collectively and/or separately referred to as dock facilities)

1. GENERAL CONDITIONS

- a. All dock facilities plans shall be prepared and stamped by a Professional Land Surveyor and/or Professional Engineer as deemed appropriate by the Commission. All plans shall show property lines and bathymetric information at one foot contour intervals.
- b. The applicant shall provide to the Shellfish Constable and Harbormaster copies of all applications and plans of the project submitted to the Conservation Commission. The application must include the actual data generated on site. Data shall include at least size and frequency distributions for shellfish found, soil analyses, map of any eelgrass beds or salt marsh present, slope of bottom, depth and distance to nearest channel. The Shellfish Constable and Harbormaster shall have ten working days to comment to the Conservation Commission. If there are no written comments received by the Commission within 10 working days, it is assumed that these officials have no concerns with the proposed project.
- c. Dock facilities, seaward of MHW, shall not be permitted in areas that would result in any adverse impact/significant effect to shellfish and/or their habitat. Dock facilities shall not be permitted in areas where the accompanying boat traffic would adversely impact/significantly effect the shellfish, finfish and/or their habitat. The Commission may allow mitigation of the project effects if deemed appropriate and found to enhance the protection of the wetland resources and the interests of the Town of Dennis Wetlands Protection Bylaw. All mitigation projects shall be reviewed and approved by the Conservation Commission in consultation with the Department of Natural Resources and the Shellfish Constable prior to the issuance of an Order of Conditions. All mitigation projects shall include monitoring protocols and measurable performance standards/success thresholds.
- d. All docking and loading facilities shall require a minimum of 3 (three) foot depth at mean low water without benefit of dredging.
- e. At all normal levels of the tide along the shoreline, passage shall be provided.
- f. No boats, dinghies, floats or appurtenances shall be kept or stored so that they adversely impact shellfish habitat, salt marsh, bordering vegetated wetland, coastal bank or coastal dune.

2. CONSTRUCTION REQUIREMENTS

- a. All work and materials shall be consistent with water quality goals. Dock facilities, whenever practicable, shall be fabricated in an upland area to prevent residue and sawdust from entering any wetland resource area. Dock facilities shall not be constructed with materials containing creosote or CCA.

- b. Piers, ramps and boardwalks shall be limited to open pile supported construction.
No solid fill shall be used.
- c. Piers, ramps and boardwalks shall cross no more than one hundred fifty (150) feet of saltmarsh, vegetated wetlands, mud flats or mapped shellfish/shellfish habitat areas, shall be no wider than four feet and elevated a minimum of one foot in height for each one foot of width above existing grade.
- d. Floats shall be limited to a maximum width of ten feet.

SECTION 4: VARIANCE

The Commission may grant a variance, in an Order of Conditions from these regulations when the Commission finds that, given existing conditions, the proposed project will serve to lessen impacts to and/or substantially enhance the interests identified in the Bylaw and there are no other reasonable conditions or alternatives that would allow that project to proceed in compliance with the rules and regulations. The burden of proof to demonstrate compliance in protecting the interests identified in the Bylaw shall be the responsibility of the owner/applicant. The variance shall be requested in writing and shall be submitted as part of the Notice of Intent under the Town of Dennis Wetlands Protection Bylaw.

SECTION 5: GENERAL POLICIES

1. All Orders of Conditions shall be valid for three years from the date of issue unless revoked or extended by separate action of the Conservation Commission. Certificates of Compliance shall be requested upon completion of work or upon expiration of the Orders of Conditions.
2. Onsite sewage disposal upgrades shall be allowed to file as a Request for Determination if the following conditions are met:
 - a) the leaching facilities for the upgrade is in excess of 100' from all wetland resource areas, with the exception of land subject to coastal storm flowage (A Zone only) and the outer riparian zone of the Riverfront area or
 - b) if the leaching facilities for the upgrade is in excess of 50' but less than 100' from a wetland resource area, with the exception of land subject to coastal storm flowage (A Zone only) and the outer riparian zone of the Riverfront area, and the upgrade design incorporates the best available design facilities as permitted by MaDEP under Title 5 piloting, provisional and/or general use provisions for treatment to less than 19ppm TN, 1ppm TP, 30ppm TSS and 30ppm BOD with pre approved monitoring protocols
3. The following activities within the Buffer Zone shall be considered minor and therefore not subject to regulation under the Town of Dennis Wetlands Protection Bylaw.
 - A. Landscaping Activities:
 1. Existing Altered/Planted Areas:
 - mowing of existing lawn areas, not currently the subject of an enforcement action.
 - maintenance trimming of existing planted landscape areas, trimming of poison ivy, bittersweet and honeysuckle (Lonicera) excluding other natural and native vegetation, not currently the subject of an enforcement action.
 - conversion of impervious to vegetated surfaces, provided erosion and sedimentation controls are implemented and debris transported outside of buffer zone.

In all other instances, landscaping activities within the Buffer Zone shall be allowed as approved onsite and stated in writing by the Conservation Commission Agent.

B. Structural Activities:

- maintenance of existing structures predating 1972, 1975 and/or structures permitted by an Order of Conditions or Request for Determination of Applicability.
- fencing, providing it will not constitute a barrier to wildlife movement

4. All presently developed lots on which the buffer zone has been disturbed, the undisturbed buffer zone for future activities shall be set at a distance equal to the existing lawfully disturbed setback from the most landward wetland resource area.
5. Filing fees are established by the Commission for the filing of a Notice of Intent, Abbreviated Notice of Intent, and Request for Determination of Applicability, etc. The Conservation Commission, at its discretion, may from time to time change these fees.
6. The applicant shall be responsible for providing a copy of the Dennis Conservation Commission's Order of Conditions to the Building and Health Departments. When work permitted by the Order of Conditions (OOC) includes any component of a septic system, copies of the OOC and Plan of Record shall be provided by the applicant to the Board of Health. When work permitted by the OOC includes construction, alteration, removal or moving of any structure, fence or drainage facilities or the cutting and clearing of vegetation, copies of the OOC and Plan of Record shall be provided by the applicant to the Building Department.
7. Attention is hereby called to the "Instructions to Applicants" as attached to the appropriate forms. Work done under an Order of Conditions shall, as deemed appropriate, be supervised by the Natural Resource Officer, an employee of the Conservation Commission and/or a consultant hired by the Conservation Commission.
8. Non criminal disposition of violations is authorized by the Town of Dennis Wetlands Protection Bylaw. The Commission or its agents, at their discretion, may issue up to the maximum fine allowable per day, per offense.

Rules and Regulations
Established January 31, 1989
Revised 10/23/00
Revised 8/19/05

APPENDIX

**A. 50 (FIFTY) FOOT NO DISTURB ZONE FROM A WETLAND
RESOURCE**

B. NEW OR EXPANDED DOCK FACILITIES

**C. SEPTIC SYSTEM LEACHING FACILITIES PROHIBITION WITHIN
100 FEET OF WETLAND RESOURCE AREAS**

A. 50 (FIFTY) FOOT NO DISTURB ZONE FROM A WETLAND RESOURCE AREA (Exclusive of land subject to coastal storm flowage)*

Wetland resource areas are recognized as providing many functions and values to society including flood control, groundwater recharge and discharge, water quality improvement, shoreline stabilization, fish, shellfish and wildlife habitat, recreational and educational opportunities and aesthetic values. Wetland buffer zones protect the functions and values of adjacent wetland resources by maximizing water quality, by sustaining hydrology, and by promoting fish, shellfish, wildlife and plant diversity and abundance.

1 – Water Quality – Wetlands are generally located in low areas of the landscape, thereby being susceptible to sediment loading from upland sources and to erosion scouring that results from increased water velocities from mismanaged upland surface waters.

Vegetated wetland buffers function to reduce adverse impacts to water quality by controlling the severity of soil erosion and removing pollutants from storm water runoff. Soil erosion is reduced within buffers as vegetation and organic debris shields the soil from rain and binds soil particles with root materials. Vegetation acts as an obstruction to water flow thereby decreasing velocities, allowing infiltration and reducing the erosion potential of storm water runoff. As a physical barrier to flowing water, vegetation also traps sediments and other insoluble pollutants. Soluble nutrients and pollutants are also removed or transformed by the soils, bacteria and plants in wetland buffers. Vegetated buffers also scatter sunlight and provide shade, reducing water temperature in the summer, limiting nuisance algae growth and reducing the release of nutrients from the sediment.

2 – Hydrology – Wetland buffers assist in moderating water level fluctuations.

Vegetation impedes the flow of runoff and allows it to infiltrate into the ground. The soil then yields this water to the wetland over an extended period of time; thereby, supporting and stabilizing the natural ecosystem. Vegetation also produces litter, which increases the humus content of the soil, which increases absorption and infiltration.

3 – Shellfish, fish, wildlife and plant habitat – The vegetated buffers to wetlands have been documented to be one of the richest zones for aquatic organisms, mammals, birds and plants. 77% of the 86 freshwater wetland dependent animal species in Massachusetts require upland areas. The buffer zone provides essential habitat features to wildlife such as vegetation structure and composition, upland substrate, snags and downed logs, woody debris, banks for nesting, etc. These buffer areas are used for dispersal, feeding, basking, hibernation/aestivation and nesting. The buffers serve to attenuate pollutants and moderate temperature changes for fish and shellfish habitat. These areas also serve as nurture zones for plant diversity. Wildlife and plant species have varying spatial requirements to maintain viable populations for survival. Buffer zones provide an area where animals and some plant varieties have needed separation and interspersions to reduce competition and maintain populations. Habitat alterations and land use changes within buffer zones can affect wetland dependent animal and plant species by fragmenting habitat to nonfunctional sizes and shapes.

4 – Direct Human Disturbance – Vegetated buffers provide visual and physical separation between wetlands and developed environments. Buffers discourage direct human disturbance within a wetland from dumping of debris, cutting of vegetation or trampling.

The width of buffer considered appropriate to protect a wetland from degradation is related to the wetland functions being protected and buffer functions being provided. Buffer zones provide the following functions:

- Sediment removal
- Nutrient cycling
- Fecal coliform removal
- Temperature moderation
- Human impact deterrence
- Wetland species distribution and diversity

Scientific studies have documented that buffer effectiveness increases with buffer width and that buffer zones less than 50 feet in width are generally ineffective in protecting wetlands. Undisturbed buffer zones 50 feet and wider are necessary to protect wetlands from an influx of sediment and nutrients, to protect wetlands from direct human disturbance, to protect sensitive wildlife species and plant habitat from adverse impact and to protect wetland from adverse effects of changes in the quantity and temperature of water entering the wetland. Uplands immediately adjacent to wetlands vary in their ability to reduce adverse effects of development/land use change dependent upon their slope and % vegetative cover. Currently the Massachusetts Wetlands Protection Act and Regulations regulate the buffer zone only to protect the wetland from overland flow discharges of excess soil particles or other undesirable byproducts into the wetland. Wetland resource health and sustainability can be measured in terms of water quality, hydrology, plant and animal species diversity and abundance, which as stated above are the protective functions provided by wetland buffer areas. These functions are not protected or regulated, except for soil erosion and transport, by existing, and even less by proposed state statutes.

***References:**

- Boyd, Lynn 2001. Wildlife Use of Wetland Buffer Zones and their Protection under the Massachusetts Wetlands Protection Act. University of Massachusetts Department of Natural Resources Conservation 33pp.
- Castelle, A. J. et al 1992. Wetland Buffers: Use and Effectiveness. Adolfson Associates, Inc., Shorelands and Coastal Zone Management Program, Washington Dept. of Ecology, Olympia, Pub. No. 92-10
- Berkshire Regional Planning Commission 2003. Massachusetts Vegetated Buffer Manual prepared for Massachusetts Department of Environmental Protection.

B. NEW OR EXPANDED DOCK FACILITIES*

Impacts relating to dock facilities occur during construction and use phases. The Commission recognizes that short term construction impacts can often be mitigated, however, ongoing use impacts constitute long term impacts that can and frequently do, adversely effect water quality and habitat. In order to maximize protection of shellfish And associated habitat areas recognized by the Town of Dennis to be significant to public resources, the construction of new and/or the enlargement of existing dock facilities shall not be permitted if their construction or use would result in any adverse effect/significant effect to shellfish, their habitat and/or aquaculture areas. This prohibition may be overcome if the Commission deems that proposed mitigation will serve to enhance the protection of the wetland resource and the interests of the Town of Dennis Wetlands Protection Bylaw, will serve to insure that water quality within shellfish management/aquaculture areas important to public recreation interests and shellfish populations and biodiversity will not be adversely effected by conflicting boating use. Water quality effects resulting from construction and use of dock facilities include, but are not limited to:

- Alterations in water circulation
- Alterations in the distribution of sediment grain size
- Changes in dissolved oxygen, nutrients, temperature, turbidity and or
- The addition of pollutants

**Reference Massachusetts Coastal Zone Management Pier and Dock Facilities Guidelines and Barnstable County Extension Service Dock and Pier Project Draft Report dated 9/23/02; The Effects of Boat Docks on Eelgrass Beds in Coastal Waters of Massachusetts by Burdick and Short in Environmental Management Vol 23 No. 2 pp 231-240; and Environmental and Aesthetic Impacts of Small Docks and Piers NOAA Coastal Ocean Program Decision Analysis Series No. 22*

C. SEPTIC SYSTEM LEACHING FACILITIES PROHIBITION WITHIN 100 FEET OF WETLAND RESOURCE AREAS

Groundwater supply and quality is critical to the health of Town of Dennis wetland resource areas and protected interests. Alterations to the landscape resulting from human activities have been documented to adversely affect both groundwater supply and groundwater quality. Under the provisions of the Town of Dennis Wetlands Protection Bylaw, the Conservation Commission is charged with protecting the health of wetland resource areas and interests. Accordingly, to maximize protection of groundwater resources, freshwater wetland resources and coastal wetland resources, leaching facilities for onsite sewage disposal shall not be located within any wetland resource area or buffer zone to any wetland resource area, with the exception of land subject to coastal storm flowage (A Zone only). This prohibition proceeds based on the following rationale:

- Contaminants originating in wastewater have been shown to accelerate natural processes in wetland resource areas (eutrophication) to the point where the negative effects on the interests expressed in the Town of Dennis Wetlands Protection Bylaw may be substantial. Accordingly, the best available information should be incorporated into resource management policy and regulations to avoid or limit these effects. (George Heufelder, Director Barnstable County Health Dept.)
- Greater horizontal separation between wetland resources and facilities that emanate wastewater provides a treatment zone in which contaminant levels can return more closely to their undisturbed background levels. (George Heufelder, Director Barnstable County Health Dept.)
- Contaminants that impact the public health status of certain resource areas (such as shellfish areas and bathing beaches) have occurred at horizontal separations that are less restrictive than the boundary of the buffer zone (George Heufelder, Director Barnstable County Health Dept.)
- An undisturbed buffer zone (area where no contaminants are being released) serves as a mitigating area which facilitates the dilution of contaminants originating from outside the buffer area. (George Heufelder, Director Barnstable County Health Department)
- The physical disturbance of surface vegetation and soil structure that is associated with leach field construction and placement can alter the ability of the buffer zone to attenuate the effects of activities that effect the resource areas, thus negating the purpose and function of the buffer zone. (George Heufelder, Director Barnstable County Health Department)
- Public health thresholds for nitrogen loading is generally set at 5 or 10 ppmTN. The Conservation Commission interests include drinking water supplies and wetland resource interests. Nitrogen loading to brackish and salt water resources may result in eutrophication of those resources. Best available information from the Commonwealth of Massachusetts Estuaries Program and the Cape Cod Commission indicates a loading rate of less than 1.0 ppm total nitrogen (TN) to trigger eutrophication to nitrogen sensitive resource areas. (Cape Cod Commission Water Resources)

TOWN OF YARMOUTH WETLAND PROTECTION REGULATIONS

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PART 1. GENERAL PROVISIONS

1.01 General Purpose

(1) Introduction

These regulations are promulgated by the Town of Yarmouth Conservation Commission pursuant to the authority granted to it under Chapter 143, Section 2, D of the Town of Yarmouth Wetland By-law, (hereinafter referred to as the "By-law"). These regulations shall complement the By-law, and shall have the force of law upon their effective date.

(2) Purpose

The By-law sets forth a public review and decision making process by which activities having an impact or cumulative effect upon Areas Subject to Protection Under the By-law are to be regulated in order to ensure the protection of the following interests:

- Private and Public Water Supply
- Groundwater and Groundwater Quality
- Surface Water Quality
- Flood Control
- Erosion and Sedimentation Control
- Storm Damage Prevention
- Water Pollution Control
- Wildlife and Wildlife Habitat
- Fisheries
- Shellfish and Land Containing Shellfish
- Recreation

The purpose of these regulations is to define and clarify that process by establishing standard definitions and uniform procedures by which the Yarmouth Conservation Commission may carry out its responsibilities under the By-law.

1.02 Statement of Jurisdiction

(1) Areas subject to Protection Under the By-law. The following areas are subject to protection under the bylaw:

- (a) Any freshwater wetland, coastal wetland, marsh, wet meadow, bog, swamp, bank, beach, dune or flat.
- (b) Any land within 100 feet of any of the areas set forth in section 1.02, (a) above.

- (c) Any lake, river, pond, stream, estuary, watercourse, or the ocean.
- (d) Any land under any of the water bodies set forth in section 1.02, (c), above.
- (e) Any land within 100 feet of the water bodies set forth in section 1.02, (c), above.
- (f) Any land subject to inundation by groundwater, surface water or tidal action.
- (g) Any land within 100 feet of any land subject to flooding or inundation as set forth in section 1.02, (1), (g), above.
- (h) Any land subject to coastal storm flowage.
- (i) Portions of land within Coastal Watershed Areas and Lake and Pond Recharge Areas as mapped by the "Water Resources Protection Study" for the Town of Yarmouth, dated August, 1988 by I.E.P. and Wright Pierce.

(2) Activities Subject to Regulation Under the By-law

- (a) Any activity proposed or undertaken which will constitute removing, filling, dredging, building upon or altering any area specified in section 1.02, (1) is subject to regulation under the By-law and requires the filing of either a Notice of Intent or a Request for Determination of Applicability.
- (b) Any activity proposed or undertaken out the areas specified in section 1.02, (1) above shall not be subject to regulation under the By-law unless, in the judgment of the Conservation Commission, said activity will result or has resulted in the removing, filling, dredging, building upon, or altering an area specified in section 1.02, (1) above.
- (c) Any person who wishes to know whether or not a proposed activity or an area is subject to the By-law may in writing request a determination from the Conservation Commission. Such a "Request for Determination of Applicability" shall be submitted pursuant to section 1.05 of these regulations.

1.03 General Provisions Concerning Burden of Going Forward and Burden of Proof

- (1) The applicant shall have the burden of going forward by providing at least some credible evidence from a competent source in support of all matters asserted by the applicant in accordance with his or her burden of proof pursuant to section 1.03, b, below.
- (2) The applicant shall have the burden of proving by a preponderance of the credible evidence that the activities proposed in the application will not harm the interests

protected by this By-law. Failure to meet the Burden of Proof shall be cause for the Commission to deny the application along with any work or activity proposed therein.

1.04 Definitions

Abutter means any person possessing whole or partial ownership of property directly adjacent to the property for which work is proposed. This shall include property across any private or public way.

Activity means any form of draining, dumping, dredging, damming discharging, excavating, filling or grading; the erection, re-construction or expansion of any buildings or structures; the driving of piles or the construction of seawalls; the construction or improvement of roads and other ways; the changing of runoff characteristics; the intercepting or diverting of ground or surface water; the installation of drainage, sewage and water systems; the discharging of pollutants; the destruction of plant life; and any other changing of the physical characteristics of land, or of the physical, biological or chemical characteristics of water.

Alter means to change the condition of any Area Subject to Protection Under the By-law. The term "alter" shall include, but not be limited to the following activities when undertaken to, upon, within or affecting Resource Areas protected by the By-law:

- (a) Removal, excavation or dredging of soil, sand, gravel, or aggregate materials of any kind;
- (b) Changing of pre-existing drainage characteristics, flushing characteristics, salinity distribution, sedimentation patterns, flow patterns or flooding characteristics;
- (c) Drainage or other disturbance of water level or water table;
- (d) Dumping, discharging or filling with any material;
- (e) Placing of fill or removal of material;
- (f) Driving of piles, erection of buildings or structures of any kind;
- (g) Placing of objects or obstructions in water, (excluding boats, moorings, fish or shellfish traps, pens or trays used in conjunction with aquaculture, or aids to navigation);
- (h) Destruction of plant life including the cutting of trees and removal of existing ground cover. This shall also include aquatic flora;

- (i) Changing the water temperature, biochemical oxygen demand, or other physical, chemical, or biological characteristics of water;
- (j) Any activities, changes, or work which may cause or tend to contribute to pollution of any body of water or ground water.

Aquaculture means the growing of aquatic organisms under controlled conditions including but not limited to finfish, shellfish, amphibians, reptiles and seaweeds.

Bank (Coastal) see part 2, section 2.05, 2

Bank (Inland) see Part 3, section 3.01, 2, a

Beach (Barrier) see Part 2, section 2.04, 2

Beach (Coastal) see Part 2, section 2.02, 2, a

Beach (Inland) see Part 3, synonymous with un-vegetated inland bank.

Best Available Measures means the most up to date technology or the best designs, measures or engineering practices that have been developed or that are available.

Best Practical Measures means technologies, designs, measures, or engineering practices that are in general use to protect like or similar interests.

Bog see Part 3, 3.02, 2, a, 1.

Bordering means touching.

Boundary means the boundary of and Area Subject to Protection Under the By-law.

Certificate of Compliance means a written determination by the Conservation Commission that the proposed work or a portion thereof has been completed in accordance with a pertinent Order of Conditions.

Coastal Engineering Structure means any bulkhead, revetment, seawall, Rip-rap, groin, jetty or other structure intended to prevent or alleviate storm damage, tidal action, wave action, littoral flow or erosion caused by any of foregoing.

Commission means the Yarmouth Conservation Commission.

Conditions means those requirements set forth in a "Order of Condition" issued by the Conservation Commission for the purpose of permitting, regulating, or prohibiting any activity that removes, fills, dredges, builds upon or alters and Area Subject to Protection Under the By-law.

Conservation Commission means that body comprised of members lawfully appointed pursuant to M.G.L. Chapter 40, section 8c.

Creek means the same as a stream.

Date of Issuance means the date an Order of Conditions, Determination of Applicability, Extension Permit, Enforcement Order, or Certificate of Compliance is mailed, as evidenced by a postmark, or the date it is hand delivered.

Date of Receipt means the date of delivery to an office, home or usual place of business by mail or hand delivery.

Department means Massachusetts Department of Environmental Protection, (D.E.P.).

Determination of Applicability means a written finding by the Commission as to whether a site or the activity proposed thereon is subject to the jurisdiction of the By-law.

Dredge means to deepen, widen or excavate, either temporarily or permanently.

Driveway means any means of vehicle access to a parcel of land. Driveways can occur as gravel, crushed stone, seashells, or impervious materials such as cement or bituminous concrete.

Dune means Coastal Dune, see Part 2, section 2.03, 2.

Erosion Control means the prevention or reduction of the detachment or movement of soil or rock fragments by water, wind, ice or gravity.

Estuary means any area where fresh and salt water mix and tidal effects are evident and also any partially enclosed coastal body of water where the tide meets the current of any stream or river.

Extension Permit means a written extension of time within which the authorized activity shall be completed.

Fill means to deposit any material so as to raise an elevation, either temporarily or permanently.

Flat (tidal) see Part 2, section 2.02, 2, b.

Flood Control means the prevention or reduction of flooding and or flood damage.

Freshwater Wetlands, see Part 3, section 3.02, 2, a.

Ground Water Supply means water below the earth's surface in the zone of saturation.

Interests means the wetland values, (collectively, the "interests" protected by this By-law), specified in chapter 143, section 1 of the By-law and section 1.01, 2 of these regulations.

Issuing Authority means the Yarmouth Conservation Commission.

Lake means any open body of fresh water with a surface area of 10 acres or more, and shall include great ponds.

Land Subject to Coastal Storm Flowage means land subject to any inundation caused by coastal storms up to and including that caused by the 100 year Storm, surge of record, or storm of record, whichever is greater.

Land Containing Shellfish, see Part 2, section 2.08, 2, a.

Land Subject to Flooding, see Part 3, section 3.04, 1, a. and b.

Land Subject to Flooding or Inundation by Tidal Action means land subject to the periodic rise and fall of a coastal water body including spring tides.

Land Under Water Bodies means the bottom of, or land under the surface of the ocean or any lake, river, pond, stream, estuary or watercourse. See Parts 2 and 3 for further definition.

Land Within 300 Feet of a Major Estuary means that portion of land that extends 300 feet landward or up-gradient from the actual river, creek, salt pond, or embayment and is within the 100 year frequency storm elevation as referenced on the latest available Flood Insurance Rate Maps provided by the Federal Emergency Management Agency.

Majority means more than half of the Conservation Commission members then in office.

Major Estuaries include: Bass River, Parkers River, Mill Creek, Chase Garden Creek, Bass Creek, Lone Tree Creek, Clays Creek, Short Wharf Creek, Hallets Mill Pond, Whites Brook, Lewis Bay, Lewis Pond, Swan

Pond, Dinah's Pond, Follins Pond, Kelly's Bay, Mill Pond, Crab Creek, Uncle Roberts Cove, Pine Island Creek, Sweetheart Creek, Barnstable Harbor, Cape Cod Bay, and Nantucket Sound.

Marsh, see Part 2 and 3 for definitions of salt and fresh marshes.

Notice of Intent means the written notice filed by any person intending to remove, fill, dredge or alter any Area Subject to Protection under the Mass Wetland Protection Act, M.G.L. chapter 131, section 40 and the Town of Yarmouth Wetland By-law.

Obstructions or Objects in water means but is not limited to dams, weirs, sluice gates, jetties, groins, breakwaters, piers, docks, seawalls, bulkheads, pilings, dolphins, marine railways, slips and floats.

Ocean means the Atlantic Ocean and all contiguous waters subject to tidal action.

Order means an Order of Conditions, Superseding Order of Conditions, or Final Order of Conditions, whichever is applicable, issued pursuant to M.G.L., Chapter 131, section 40 and/or the Town of Yarmouth Wetland By-law.

Party to any proceeding means the Applicant, the Conservation Commission and, pursuant to section 1.05, may include the owner of the project location, any abutter, any person aggrieved, any ten residents of the town where the land is located and any ten persons pursuant to M.G.L., chapter 30a, sec. 10a.

Person – see Chapter 143, section 3 of the By-law.

Person Aggrieved means any person who, because of an act or failure to act by the issuing authority, may suffer an injury in fact which is different either in kind or in magnitude from that suffered by the general public and which is within the scope of the interests identified in the By-law. Such person must specify in writing sufficient facts to allow the Conservation Commission to determine whether or not the person is in fact aggrieved.

Plans means such data, maps engineering drawings, calculations, specifications, schedules and other materials, if any, deemed necessary by the Conservation Commission to describe the site and activity; to determine the applicability of the By-law; or to determine the impact of the proposal upon the interests identified in the By-law.

Pond (Coastal) means Salt Pond – see Part 2, 2.07, 2.

Pond (Inland) means any open body of fresh water, either naturally occurring Or man-made by impoundment, which is never without standing water due to natural causes, except during periods of extended drought. For purposes of this definition, extended drought shall mean any period of four or more months during which the average rainfall for each month is 50% or less of the ten year average for that same month. Basins or lagoons which are part of waste water treatment plants shall not be considered ponds, nor shall swimming pools or other impervious man-made retention basins and ponds.

Prevention of Pollution means the prevention or reduction of contamination of surface or ground water.

Private Water Supply means any source or volume of surface water or groundwater demonstrated to be in any private use or demonstrated to have a potential for private use.

Protection of Fisheries means protection of the capacity of an Area Subject to Protection Under the By-law;

(a) To prevent or reduce contamination or damage to fish; and

(b) To serve as their habitat and nutrient source.

Fish includes all species of fresh and saltwater finfish and shellfish.

Protection of Land Containing Shellfish means protection of the capacity Of an Area Subject to Protection Under the By-law:

(a) To prevent or reduce contamination or damage to shellfish, and

(b) To serve as their habitat and nutrient source.

Public Water Supply means any source or volume of surface water or ground water demonstrated to be in public use or approved for water supply pursuant to M.G.L. chapter 111, section 160 by the Division of Water Supply of the D.E.P., or shown to have potential for public use.

Quorum means the majority of the duly appointed members of the Conservation Commission that when duly assembled is legally empowered to transact business.

Remove means to take away any type of material, thereby changing an elevation, either temporarily or permanently.

Request for Determination of Applicability means a written request made by any person to the Conservation Commission for a determination as to

whether a site or the proposed activity thereon is subject to the By-law.

Resource Area is synonymous with Area Subject to Protection Under the By-Law, each one of which is listed in section 1.02, (1) of these regulations.

River means any natural flowing body of water that empties to any ocean, lake or other river and which flows throughout the year.

Salt Marsh – see Part 2- 2.06, (2), a.

Sedimentation Control means the prevention or reduction of the collection or Concentrations of sand, soil or rock fragments by the action of water, wind, Ice, gravity, or machine.

Significant means plays a role. A resource area is significant to an interest identified in the By-law when it plays a role in the provision or protection, as appropriate, of that interest.

Spring Tides means those tides which occur with new and full moons, and which are perceptibly higher and lower than other tides.

Storm Damage Prevention means the prevention of damage caused by water from storms, including but not limited to; erosion and sedimentation; damage to vegetation, property or buildings; or damage caused by flooding, waterborne debris or waterborne ice.

Stream means a body of running water, including brooks and creeks, which moves in a definite channel in or under the ground due to hydraulic gradient. A portion of a stream may flow through a culvert or beneath a bridge. A stream may be intermittent, (i.e. does not flow throughout the year). A stream may also be man-made.

Structure means any building, shed, deck, driveway, road, septic component, dock, pier, bulkhead, revetment, groin, float, pipeline, fence, guardrail, pool, tennis court or other playing surface, drainage component, storage tank, etc.

Vegetated Wetlands – see Part 3.

Water Dependent Use means any structure or activity that relies solely on the presence of a salt or fresh water body to justify its existence. Docks, floats, dredging, and seawalls would be considered water dependent structures and use. Houses, pools, garages and decks would not be considered water dependent structures.

Wet Meadow – see Part 3.

Wildlife Habitat means areas having plant community composition and structure, hydrologic regime, or other characteristics sufficient to provide shelter, nutrients, growing conditions, nesting or breeding sites conducive to the propagation and preservation of wildlife. Migratory and over-wintering areas shall also be included as wildlife habitat.

Wildlife means any non-domesticated mammal, bird, reptile, amphibian, fish, mollusk, plant, arthropod or other invertebrate other than a species of the class Insecta, which has been determined by the Commission to constitute a pest whose protection under the By-law would be a risk to man.

Work means the same as activity.

1.05 Procedures

- (1) Time Periods. All time periods of ten days or less specified in the By-law and these regulations shall be computed using business days only. (Saturday, Sunday, and legal holidays excluded). In the case of a Determination of Applicability or Order of Conditions, such period shall commence on the first day after the date of issuance and shall end at the close of business on the tenth business day thereafter. All other time periods specified in the By-law and these regulations shall be computed on the basis of calendar days, unless the last day falls on a Saturday, Sunday or legal holiday, in which case the last day shall be the next business day following.
- (2) Actions by Conservation Commission. Where the By-law states that a particular action, (except receipt of a Request for Determination of Applicability or Notice of Intent), is to be taken by the Commission, that action is to be taken by more than half of the members present at a meeting of at least a quorum. Where the By-law states that a permit or notification shall be issued by the Conservation Commission, that action is to be taken by a majority of the members then in office, who need not convene as a body in order to sign said permit or notification, provided they met pursuant to the Open Meeting Law, M.G.L. chapter 39, sections 23-A through 23-C when voting on the matter. Where the By-law states that the Conservation Commission is to receive a Request for Determination of Applicability or a Notice of Intent, Conservation Commission means a member of the Conservation Commission or an individual designated by the Conservation Commission to receive such Request for Determination of Applicability or Notice of Intent.
- (3) Determination of Applicability
 - (a) Requests for Determination of Applicability

- (1) Any person who desires a determination as to whether the By-law applies to a site or an activity that may affect an Area Subject to Protection Under the By-law, may submit to the Commission by certified mail or hand delivery a Request for Determination of Applicability.
- (2) When a person requesting a determination is other than the owner, the request, the notice of the hearing and the determination itself shall be sent by the Commission to the owner as well as the person making the request, and the applicant shall supply the Commission with the name and the current address of the owner.

(b) Determination of Applicability

- (1) Within 21 days after the date of receipt of a Request for Determination of Applicability, the Commission shall hold a public hearing on the request. Notice of the time and place of the public hearing at which the Determination will be made shall be given by the Commission, at the expense of the person making the Request, not less than five days prior to such hearing, by publication in a newspaper of general circulation in the town, and by mailing a notice to the person making the Request and to the owner. Notice shall also be given in accordance with the Open Meeting Law, M.G.L. chapter 39, section 23b.
- (2) At the public hearing the Commission will determine:
 - (a) Positively: that the area and the activity proposed thereon are subject to the jurisdiction of the By-law and that the activity is deemed to affect one or more interests protected in the By-law.
 - (b) Negatively: that the area in which the proposed activity is to take place is not within the jurisdiction of the By-law or that the proposed activity is not deemed to affect one or more of the interests protected under the By-law.
- (3) The Determination shall be signed by a majority of the Commissioners present at the public hearing, and shall be sent by the Commission to the person making the Request and a copy, if not the applicant, to the owner within 21 days of the close of the public hearing or any continuance thereof.
- (4) A Determination shall be valid for three years from date of issuance.
- (5) In the event of a positive Determination, a Notice of Intent shall be filed and all of the procedures set forth in section 1.05, (4) shall apply.

(4) Notice of Intent

- (a) Any person who proposes to do work that will remove, fill, dredge, build Upon or alter any Area Subject to Protection Under the By-law shall submit a Notice of Intent, and other application materials in accordance with the submittal requirements outlined in section 1.09 of these regulations.
- (b) The Commission in an appropriate case may accept as the application and Plans under this By-law, the Notice of Intent and plans filed under the Wetland Protection Act, M.G.L. chapter 131, section 40.
- (c) Any person filing a Notice of Intent with the Commission under the by-law shall at the same time give written notices thereof, by certified mail or hand delivery, to all abutters according to the most recent record of the Yarmouth Assessors Office, and to all other persons as the Commission shall in writing require. Applicants shall postmark such notification at least (10), ten days prior to the public hearing.
- (d) When a person filing is other than the owner, the application, the notice of the hearing, and the findings themselves shall be sent to the owner by the person filing the application, and the applicant shall also supply the Commission with the name and current address of the owner.
- (e) In the event that only a portion of the proposed project or activity lies within An Area Subject to Protection Under the By-law, all aspects of the project must be described in the detail called for by the General Instructions provided, also that in such circumstances the Notice of Intent shall also contain descriptions and calculations of peak flows and estimated water quality characteristics of discharge from a point source (both closed and open channel) when the point of discharge falls within an Area subject to Protection Under the By-law.
- (f) Notwithstanding the foregoing, when the Commission has determined that an activity outside the Areas Subject to Protection Under the By-law has in fact altered an Area Subject to Protection Under the By-law, it may require such plans, supporting calculations and other documentation as are necessary to describe the entire activity.
- (g) A Notice of Intent may be rejected by the Commission if the filing is deemed incomplete, or a Special Permit or Variance from the Zoning Board of Appeals is required and has not been applied for.

(5) Public Hearings on Notices of Intent

- (a) A public hearing on a Notice of Intent shall be held by the Commission

within 21 days of receipt of the minimum submittal requirements set forth in the General Instructions (§.4.01) and shall be advertised at the expense of the applicant at least five working days prior to the hearing in a newspaper of general circulation in the Town and in accordance with the requirements of the Open Meeting Law, M.G.L. ch. 39, §. 23B.

(b) The Commission in an appropriate case may combine its hearing under the By-law with the hearing conducted under Wetlands Protection Act, M.G.L. 131, §. 40.

(c) Public Hearings may be continued as follows:

(1) Without the consent of the applicant to a date certain, for reasons stated at the hearing, which may include receipt of additional information offered by the applicant or others, information and plans required by the applicant, deemed necessary by the Commission in its discretion, or comments and recommendations of other local or state boards and officials.

(2) With the consent of the applicant, to an agreed upon date, which shall be announced at the hearing.

(6) Permits Regulating the Work

(a) Within 21 days of the close of the public hearing the Commission shall issue an Order of Conditions, (hereinafter called "Order"), either approving or denying the project.

(b) If the project is approved, the Order shall impose such conditions as are necessary for the protection of one or more of the interests identified in the By-law. The Order shall prohibit any work or portion thereof that cannot be conditioned to protect such interests. The Order shall impose conditions upon work or the portion thereof, that will in the judgment of the Commission, result in the removing, dredging, filling, building upon or altering an area subject to protection of the By-law. The Order shall impose conditions setting limits on the quantity and quality of discharge from a point source, (both closed and open channels) when said limits are necessary to protect the interests identified in the By-law.

(c) If the project is denied, it shall be for one or more of the following reasons:

(1) For failure to meet the requirements of the By-law;

(2) For failure to submit necessary information or plans requested by the Commission;

- (3) For failure to meet design specifications, performance standards or other requirements in these regulations;
 - (4) For failure to avoid or prevent unacceptable or cumulative effects upon the wetland values protected under the By-law;
 - (5) Where no conditions are adequate to safeguard the wetland values protected under the By-law or these regulations.
- (d) An Order shall be valid for three years from the date of issuance.
 - (e) The Order shall be signed by a majority of the Commission and shall be mailed or hand delivered to the applicant, his agent or the owner of record.
 - (f) A copy of the plans describing the work and the Order shall be kept on file by the Commission and shall be available to the public at reasonable hours.
 - (g) Prior to commencement of any work permitted or required by the Order, the Order shall be recorded in the Registry of Deeds or the Land Court for the district in which the land is located within the chain of title of the affected property. In the case of recorded land, the Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of registered land, the Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is to be done. Certification of the recording shall be sent to the Conservation Commission before any work is commenced. If work is undertaken without the applicant first recording the Order, the issuing authority may issue an Enforcement Order or may itself record the Order at the applicant's expense
 - (h) For good cause the Commission may revoke or modify an Order under this By-law.
 - (i) The Commission, in an appropriate case may combine the Order or other action on an application issued under the by-law with the Order issued under the Mass Wetland Protection Act, M.G.L. Chapter 131, sec. 40.
- (7) Extensions of Permits
- (a) The Commission for one or more periods of up to three years each. Requests for extensions shall be made to the Commission in writing at least thirty days prior to the expiration of the permit.
 - (b) The issuing authority may deny the request for an extension and require

the filing of a new Notice of Intent for the remaining work in the following circumstances:

- (1) Where no work has begun on the project, except where such failure is due to an unavoidable delay, such as appeals, or in the obtaining of other permits;
 - (2) Where new information, not available at the time Order was issued, has become available and indicates that the Order is not adequate to protect the interests in the By-law;
 - (3) Where incomplete work is causing damage to the interests identified in The By-law; or
 - (4) Where work has been done in violation of the Order or these regulations.
- (c) If issued by the Conservation Commission, the Extension Permit shall be signed by a majority of the commission.
- (d) The Extension Permit shall be recorded in the Land Court or the Registry of Deeds, whichever is appropriate. Certification of recording shall be sent to the issuing authority on the stub provided at the bottom of the Extension Permit. If work is undertaken without the applicant first recording the Extension Permit, the Conservation Commission may issue an Enforcement Order or may itself record the Extension Permit at the applicant's expense.

(8) Certificates of Compliance

- (a) Upon completion of the work specified in the Order, it is mandatory for the applicant to request in writing a Certificate of Compliance. A Certificate of Compliance shall be issued by the Conservation Commission within twenty one days of receipt thereof, and shall certify that the activity or portions thereof described in the Notice of Intent and plans has been completed in compliance with the Order. If issued by the Conservation Commission, the Certificate of Compliance shall be signed by a majority of the Commission.
- (b) Prior to the issuance of a Certificate of Compliance, a site inspection shall be made by the Conservation Administrator.
- (c) If the Conservation Commission determines non-compliance after review and inspection, it may refuse to issue a Certificate of Compliance. Such refusal shall be issued within twenty one days of receipt of a request for a Certificate of Compliance, and shall be in writing and shall specify the reasons for denial.

(d) If a project has been completed in accordance with plans stamped by a registered professional engineer, architect, landscape architect or land surveyor, a written statement by such a professional person certifying substantial compliance with the plans and setting forth what deviation, if any, exists from the plans approved in the Order shall accompany the request for a Certificate of Compliance.

(e) If the Order contains conditions which continue after completion of the work, such as (but not limited to), maintenance and monitoring, the Certificate of Compliance shall specify which, if any, of such conditions shall continue. The Certificate of Compliance shall also specify to what portions of the work it applies, if it does not apply to all the work regulated by the Order.

(f) The Certificate of Compliance shall be recorded in the Land Court or the Registry of Deeds, whichever is appropriate. Certification of recording shall be sent to the issuing authority on the stub provided at the bottom of the Certificate of Compliance. Upon failure of the applicant to so record, the Conservation Commission may do so at the applicant's expense.

1.06 Emergencies

- (1) Any person requesting permission to do an emergency project shall specify why the project is necessary for the protection of the health or safety of the public and what agency of the Commonwealth or subdivision thereof is to perform the project or order it to be performed.
- (2) The request may be written or oral, but if oral must be confirmed by written notice within twenty four hours of work commencement.
- (3) A majority of the Commission must certify the work as an emergency project to be performed only for the time and place certified by the Commission for the limited purpose of abating the emergency.
- (4) An emergency certification shall be issued only for the protection of public health or safety.
- (5) The time limit for performance of emergency work shall not exceed thirty days from the day of certification by the Commission.

1.07 Severability

The invalidity of any section of these regulations shall not invalidate any other section or provision thereof, nor shall it invalidate an Order or Determination which has previously been issued.

1.08 Effective Date

The effective date of these regulations shall be April 4, 2003 and the provisions of these regulations shall apply to all applications received on or after that date.

1.09 Submittal Requirements

(1) Office Requirements

- (a) A filing fee as required by the D.E.P. will be required for a "Notice of Intent" or an "Abbreviated Notice of Intent" and the town's portion will be payable to the Town of Yarmouth.
- (b) A filing fee of \$25.00 will be required for a "Request for a Determination of Applicability" and is payable to the Town of Yarmouth.
- (c) All filings must be made on Town of Yarmouth forms. These forms will be supplied by the Conservation office.
- (d) A "Notice of Intent" or "Request for a Determination of Applicability" if hand delivered to the Commission office, must be immediately reviewed by either the office secretary or the Conservation Administrator for substantial completeness. Filings that a missing integral information will not be scheduled for public hearings until all requested information is submitted.
- (e) Filings that are mailed to the Conservation office must be sent by certified mail, return receipt requested. If information is missing, the applicant or his representative will be notified within ten working days by certified mail that the filing will not be scheduled for public hearing.
- (f) All filings must include nine sets of all documents and one list of immediate abutters.
- (g) All applications shall be submitted at least two weeks prior to the next scheduled Conservation Commission meeting.
- (h) Coastal projects such as, but not limited to, docks, piers, bulkheads, revetments, dredging and boardwalks shall require submittal of all Notice of Intent, plans and supplemental information to the Town of Yarmouth Waterways/Shellfish Committee via the Natural Resources office by certified mail or hand delivery. The applicant or his representative must provide the Conservation office proof that this has been done or the filing will not be accepted by the Conservation office.

(2) Plans and Drawing Requirements

In order to properly and accurately evaluate the potential or real effects of proposed projects:

- (a) All "Notice of Intent" and "Abbreviated Notice of Intent" applications shall be accompanied by plans prepared and stamped by a professional land surveyor or qualified professional engineer, whichever is applicable. The Commission may waive this requirement at its discretion.
- (b) All "Request for Determination of Applicability" applications shall be accompanied by a sketch or drawing showing as much detail as possible but will not require a professional land surveyor or professional engineer's services.
- (c) If the plans require a qualified professional engineer, his or hers stamp shall include his or hers signature and discipline within it.
- (d) Professionally prepared plans must show and label all relevant "Resource Areas" in proximity to the project. Labels shall reference these areas as they appear in Part 2 and Part 3 of these regulations.
- (e) All filings must be accompanied by a Town of Yarmouth locus map.
- (f) All professionally prepared plans shall show the immediate abutters of the project property.
- (g) All professionally prepared plans for projects within or directly adjacent to tidal zones shall utilize N.G.V.D. benchmarks and indicate mean high and mean low water locations.
- (h) All plans and drawings shall indicate linear measurements depicting setbacks from wetlands to all pertinent structures.
- (i) All revised plans shall show revision date and must indicate the nature of the revision within the notes.
- (j) Topographical variation must be show on all professionally prepared plans.

(3) On-Site Requirements

- (a) All proposed structures will require staking.
- (b) On-site staking must be in place by noon on the Friday prior to the hearing date.

- (c) Lot numbers must be posted and easily visible on vacant properties.
- (d) If a building currently exists on the property, its identifying number or house number must be easily visible.
- (e) The edge of each "Resource Area" relevant to the project will require staking or flagging. Stakes and flags shall be numbered in sequence and identify in writing "Resource Area" types as they appear in Parts 2 and 3 of these regulations.

(4) General Requirements

(a) Docks and Piers

- (1) Piers shall be constructed to minimize the blocking of sunlight to shellfish beds and grasses. Piers should have planks running across the width with minimum spaces of approximately $\frac{3}{4}$ inches between planks, and be a maximum of four feet wide.
- (2) Piers shall not require the elimination of existing public or commercial moorings. Piers and or vessels moored thereto shall not project into or impede navigation to and from mooring areas. The space required to navigate the applicant's vessel to and from the pier shall be taken into account, in addition to the structure itself. The same considerations also apply to the impeding of navigation in the vicinity of town landings, docks and commercial marinas, as well as the impact on town beaches and swimming areas.
- (3) Piers shall not project into waters normally used for navigation, meaning marked navigational channels.
- (4) Public rights of passage of foot across the beach in the intertidal zone, where permitted for purposes of fishing and fowling under the Public Trusts Doctrine of the Colonial Ordinance, shall be maintained.
- (5) The base of the pier shall be as close as possible to the center line of the lot, and it shall project outwards at an angle as nearly perpendicular to the shoreline as possible.
- (6) The project plans and documentation shall include the following:
 - (a) Soundings within 100 feet of the pier.
 - (b) Eel grass beds within 100 feet of the project.
 - (c) Marked navigation channels within 100 feet of pier.

- (d) Approximate shoreward boundary of any existing public or commercial mooring areas, within 100 feet of pier. A recent aerial photograph taken during the summer boating season may be used for this purpose if desired.
 - (e) Location of existing town, commercial or private piers, Town Landings and beaches within 100 feet of pier.
 - (f) Shellfish beds within 100 feet of project, (data to be obtained from Town of Yarmouth Natural Resources Department).
- (7) Lights on piers, except lights necessary for safe navigation, shall be directed downwards and shielded so as not to impair vision of persons navigating in the area, and to avoid disturbing abutting property owners and potentially disrupting wildlife behavior.
- (8) The project shall be clearly identified and staked or marked with a buoy at pier end, at the time of submission, so that town personnel may inspect the site.
- (9) A brief narrative describing the implementation of the project including methods of approach by construction equipment.
- (10) A shellfish survey conducted by a qualified marine or shellfish biologist including written results and methods.
- (11) "Shared-use" proposals, (i.e. a single pier/dock to be jointly owned and used by two or more shorefront property owners either contiguous or not) are generally to be encouraged as a way of preserving access by shorefront property owners while reducing the overall number of docks and piers that might be otherwise permitted.
- (12) Maximum length of a dock, pier and float configurations shall not be greater than 80 feet from Mean High Water. In addition, the water depth at the farthest point of the dock and associated floats from shore shall be no less than 3 feet at Mean Low Water, and this minimum depth must be available between the proposed structure and navigable channels during Mean Low Water.
- (13) New proposed docks, piers and floats shall not be allowed within:
- (a) Seventy-five feet, (75 ft.), of adjacent docks, piers and floats with the exception marinas.
 - (b) On hundred feet, (100 ft.), of a navigable channel or boat mooring.

- (c) Two hundred fifty feet, (250 ft.), from a public boat ramp, public landing, or public swimming beach.
- (14) All float configurations shall not exceed 200 square feet, with the exception of shared-use proposals.
- (15) Proposed expansion of existing docks, piers and floats shall only be allowed where there is no encroachment into navigable channels, mooring areas, or public swimming beaches. In addition, proposed expansion shall not occur beyond 80 feet from Mean High Water as outlined above.
- (16) If treated lumber is used as a construction material, only non-leaching types of preservatives shall be allowed.
- (17) Notwithstanding these criteria, certain areas shall be designated "No Dock/No Mooring Zones". "No Dock" and "No Mooring Zones" are depicted on Yarmouth GIS maps #'s 1 thru 7 entitled "Yarmouth Conservation Commission, No Dock/No Mooring Areas" and dated March 27, 2003.
- (18) Notwithstanding section 1.09, 4, a, 1 thru 19, public projects that enhance fishing, fowling and navigation may be allowed on a case by case basis when an overriding public benefit has been demonstrated.
- (19) Existing legal docks and piers that are destroyed by natural causes may be re-constructed to their original specifications as approved by the Conservation Commission and or the D.E.P. Chapter 91 Waterways License requirements. Such re-construction must be filed for in the form of a Notice of Intent within 3 years of the damage in order to qualify for re-construction.

(b) Dredging

- (1) Where any dredging is proposed, information regarding the depth, area, volume and quality of material to be removed, and the impact on animal and plant life, shall be provided.
 - (a) Supply sediment size and type and direction of littoral drift.
 - (b) Location of shellfish beds, (data to be obtained from Town of Yarmouth Natural Resources Department).
 - (c) A shellfish survey conducted by a qualified marine or shellfish biologist including written results and methods.

- (d) Location of eel grass beds.
 - (e) Effects on wave attack including height, angle and velocity.
 - (f) Existing navigation channels within 100 feet of area to be dredged.
 - (g) Soundings within 100 feet of area to be dredged.
 - (h) Location of existing public piers, private piers, public landings, public beaches and private beaches within 100 feet of the area to be dredged.
 - (i) Turbidity control plan.
 - (j) Proposed time table.
- (c) Setbacks
- (1) Notwithstanding section 2 below, no new structures, (with the exception of water dependent structures), will be allowed within 50 feet of the following Resource Areas:
- (a) Coastal Dunes
 - (b) Coastal Banks
 - (c) Coastal Beaches
 - (d) Salt Marshes
 - (e) Inland Banks
 - (f) Vegetated Wetlands
 - (g) Streams
 - (h) Rivers
 - (i) Ponds
 - (j) Lakes
 - (k) Isolated Land Subject to Flooding
 - (l) Bordering Land Subject to Flooding

- (2) Minor structures such as sheds, decks and small additions may be allowed closer than 50 feet to a Resource Area but no closer than 35 feet.
- (3) With the exception of "Vista Pruning" as allowed below, a 35 foot undisturbed natural vegetative buffer shall be maintained between all projects and Resource Areas mentioned in (1), (a) through (l) above.
- (4) "Vista Pruning" may be allowed on a case by case basis subject to the following provisions:
 - (a) A "Notice of Intent" application shall be required.
 - (b) Canopy areas shall not be pruned by more than 50 percent.
 - (c) Portions of dense understories may be removed provided they are replaced by other types of suitable vegetation.
 - (d) If adverse impacts occur to the adjacent Resource Area(s) as a direct result of the "Vista Pruning", the Commission will require immediate mitigation in order to correct such impacts. This provision shall be noted within the "Order" issued to the applicant.

PART 2. REGULATIONS FOR COASTAL WETLANDS

2.01 Land Under the Ocean

(1) Preamble:

Land Under the Ocean is likely to be important to the protection of wildlife, wildlife habitat, marine fisheries and, where there are shellfish, to the protection of land containing shellfish. Nearshore areas of land under the ocean are likely to be important to storm damage prevention and flood control.

Land under the ocean provide feeding areas, spawning and nursery grounds and shelter for many coastal organisms related to marine fisheries.

Nearshore areas of land under the ocean help reduce storm damage and flooding by diminishing and buffering the high energy effects of storms. Submerged sand bars dissipate storm wave energy. Such areas supply a source of sediment for seasonal re-building of coastal beaches and dunes.

The bottom topography of nearshore areas of land under the ocean is important to storm damage prevention and flood control.

Water circulation, distribution of sediment grain size, water quality, finfish and shellfish habitat are factors critical to the protection of marine fisheries and wildlife habitat.

(2) Definition:

- (a) "Land Under the Ocean" means land extending from the mean low water line to the seaward limit of Yarmouth's jurisdiction.
- (b) "Nearshore Areas" of land under the ocean means that land extending from the mean low water to the seaward limit of Yarmouth's jurisdiction.

(3) Performance Standards: Improvement dredging for navigational purposes affecting land under the ocean shall be designed and carried out using the best available measures so as to minimize adverse effects caused by changes in:

- (a) bottom topography which will result in increased flooding or erosion caused by an increase in the height or velocity of waves impacting the shore;
 - (b) sediment transport processes which will increase flood or erosion hazards by affecting the natural replenishment of beaches;
 - (c) water circulation which will result in an adverse change in flushing rate, temperature, or turbidity levels; or
 - (d) marine productivity which will result from the suspension or transport of pollutants, the smothering of bottom organisms, the accumulation of pollutants by organisms, or the destruction of habitat or nutrient source areas.
- (4) Maintenance dredging for navigational purposes affecting land under the ocean shall be carried out using the best available measures so as to minimize adverse effects caused by changes in marine productivity which will result from the suspension or transport of pollutants, increases in turbidity, the smothering of bottom organisms, the accumulation of pollutants by organisms, or the destruction of habitat or nutrient source areas.
- (5) Projects not included in section 2.01, (3) or 2.01, (4) which affect nearshore areas of land under the ocean shall not cause adverse effects by altering the bottom topography so as to increase storm damage or erosion of coastal beaches, coastal banks, coastal dunes, or salt marshes.
- (6) Projects not included in section 2.01, (3) which affect land under the ocean shall be designed and performed so as to cause no adverse effects on wildlife, marine fisheries or shellfisheries caused by:
- (a) alterations in water circulation;

- (b) destruction of eelgrass beds (*Zostera marina*);
- (c) alterations in the distribution of sediment grain size; or
- (d) changes in water quality, including, but not limited to, other than natural fluctuations in the level of dissolved oxygen, temperature, turbidity, or the addition of pollutants such as Fecal coli, pathogens, etc.

2.02 Coastal Beaches and Tidal Flats

(1) Preamble:

Coastal beaches, which are defined to include tidal flats, are significant to wildlife, wildlife habitat, storm damage prevention, flood control, and recreation. In addition, tidal flats are likely to be important to the protection of wildlife, wildlife habitat, marine fisheries, and where there are shellfish, to land containing shellfish.

Coastal beaches dissipate wave energy by their gentle slope, their permeability and their granular nature, which; in turn, permit changes in beach form in response to changes in wave conditions. Coastal beaches serve as a sediment source for dunes and subtidal areas. Steep storm waves cause beach sediment to move offshore, resulting in gentler beach slope and greater energy dissipation. Less steep waves cause an onshore return of beach sediment, where it will be available to provide protection against future storm waves.

A coastal beach at any point serves as a sediment source for coastal areas downdrift from that point. The oblique approach of waves moves beach sediment alongshore in the general direction of wave attack. Thus, a coastal beach is a body of sediment which is continuously moving along the shore.

Coastal beaches serve the purposes of storm damage prevention and flood control by dissipating wave energy, by reducing the height of storm waves, and by providing sediment to supply other coastal features, including coastal dunes, land under the ocean, and other coastal beaches. Interruptions of these natural processes by man made structures reduce the ability of the coastal beach to perform these functions.

Tidal flats are likely to be important to the protection of marine fisheries because they provide habitats for marine organisms, such as polychaete worms and mollusks, which in turn are food sources for fish.

Tidal flats are also sites where organic and inorganic may become entrapped and then returned to the photosynthetic zone of the water column to support algae and other primary producers of the marine food web.

Land within 100 feet of a coastal beach or tidal flat is likely to be important to the protection and maintenance of coastal beaches and tidal flats, and therefore to the protection of wetland values which these areas contain.

The following characteristics of coastal beaches are critical to the protection of marine fisheries, wildlife, and wildlife habitat:

- (a) distribution of sediment grain size;
- (b) water circulation;
- (c) water quality, and
- (d) relief and elevation

The following characteristics of coastal beaches are critical to storm damage prevention or flood control:

- (a) volume, (quantity of sediments), form and the ability to respond to wave action.

(2) Definition:

- (a) "Coastal Beach" unconsolidated sediment subject to wave, tidal or coastal storm action which forms the gently sloping shore of a body of salt water and includes tidal flats. Coastal beaches extend from the mean low water line landward to the coastal dune line, coastal bank line or the seaward edge of existing man made structures, when these structures replace one of the above lines, whichever is closest to the ocean.
- (b) "Tidal Flat" means any nearly level part of a coastal beach which usually extends from the mean low water line landward to the more steeply sloping face of the coastal beach or which may be separated from the beach by land under the ocean.

(3) Performance Standards: Any activity which is allowed on a coastal beach or tidal flat or within 100 feet of a coastal beach or tidal flat shall not have an adverse effect on the coastal beach or tidal flat by:

- (a) affecting the ability of the waves to remove sand from the beach or tidal flat;
- (b) disturbing the vegetative cover, if any, so as to destabilize the beach or tidal flat;
- (c) causing any modification of the beach or downdrift beach that would increase the potential for storm or flood damage;

- (d) interfering with the natural movement of the beach or tidal flat;
- (e) causing artificial removal of sand from the beach or downdrift beach.

2.03 Coastal Dunes

(1) Preamble:

All coastal dunes are likely to be important to storm damage prevention and flood control. All coastal dunes on barrier beaches and the coastal dune closest to the coastal beach in any area are significant to storm damage prevention and flood control. Coastal dunes are also often significant to the protection of wildlife and wildlife habitat.

Coastal dunes aid in storm damage prevention and flood control by supplying sand to coastal beaches. Coastal dunes protect inland coastal areas from storm damage and flooding by storm waves and elevated sea levels because such dunes are higher than the coastal beaches which they border. In order to protect this function, coastal dune volume must be maintained while allowing its shape to conform to natural wind and water flow patterns. Vegetative cover contributes to the growth and stability of coastal dunes by providing conditions favorable for sand deposition.

On retreating shorelines, the ability of coastal dunes bordering a coastal beach to move landward at the rate of shoreline retreat allows these dunes to maintain their form and volume.

Land within 100 feet of a coastal dune is likely to be significant to the protection and maintenance of coastal dunes, and therefore to the protection of wetland values which these areas contain.

The following characteristics of coastal dunes are critical to storm damage prevention, flood control, protection of wildlife, and wildlife habitat:

- (a) the ability of the dune to erode in response to coastal beach conditions;
- (b) dune volume;
- (c) dune form, which must be allowed to be changed by wind and natural water flow;
- (d) vegetative cover;
- (e) the ability of the dune to move landward or laterally; and
- (f) the ability to continue serving as a bird nesting habitat.

(2) Definition:

“Coastal Dune” means any hill, mound or ridge of sediment landward of a coastal beach, deposited by wind action, storm overwash or artificial means.

(3) Performance Standards: Any activity which is allowed on a coastal dune or within 100 feet of a coastal dune shall not have an adverse effect on the coastal dune by:

- (a) affecting the ability of waves to remove sand from the dune;
- (b) disturbing the vegetative cover so as to destabilize the dune;
- (c) causing any modification of the dune form that would increase the potential for storm or flood damage;
- (d) interfering with the landward or lateral movement of the dune;
- (e) causing artificial removal of sand from the dune; or
- (f) interfering with mapped or otherwise identified bird nesting habitat.

(4) The following projects may be permitted, provided they adhere to the provisions of section 2.03, (3):

- (a) elevated pedestrian walkways, designed to minimize disturbance to vegetative cover, and traditional bird nesting habitat. Walkways shall have a minimum clearance of two feet above any existing vegetation;
- (b) fencing and other devices designed to increase dune development; and
- (f) plantings compatible with the natural vegetative cover.

2.04 Barrier Beaches

(1) Preamble:

Barrier beaches are important to wildlife, wildlife habitat, storm damage prevention, flood control, recreation and are likely to be significant to the protection of marine fisheries and, where there are shellfish, to the protection of land containing shellfish.

Barrier beaches protect landward areas because they provide a buffer to storm waves and to sea levels elevated by storms.

Barrier beaches protect from wave action such highly productive areas as salt marshes, estuaries, lagoons, salt ponds and fresh water marshes and ponds, which in turn, are important to marine fisheries, wildlife, and wildlife habitat.

Barrier beaches are maintained by the longshore movement of beach sediment caused by wave action. The coastal dunes, beaches and tidal flats are made up of sediment supplied by wave action, storm wave overwash and tidal inlet deposition. Barrier beaches in Massachusetts undergo a landward migration caused by the landward movement of sediment by wind, storm wave overwash and tidal current processes. The continuation of these processes maintains the volume of the landform which is necessary to carry out its storm and flood buffer functions.

Barrier beaches are significant to storm damage prevention, flood control and to the characteristics of coastal beaches, tidal flats and coastal dunes listed in sections 2.02, (1) and 2.03, (1). The ability to respond to wave action including storm overwash sediment transport is critical to the protection of wetlands values of barrier beaches identified above.

(2) Definition:

“Barrier Beach” means a narrow, low-lying strip of land generally consisting of coastal beaches and coastal dunes extending roughly parallel to the trend of the coast. It is separated from the mainland by a narrow body of fresh, brackish or saline water or a marsh system. A barrier beach may be joined to the mainland at one or both ends.

- (3) Performance Standards: The provisions of sections 2.02, (3) and 2.03, (3) through 2.03, (4) shall apply to the coastal beaches and to all coastal dunes which make up a barrier beach.

2.05 Coastal Banks

(1) Preamble:

Coastal banks are likely to be important to storm damage prevention and flood control. Coastal banks that supply sediment to coastal beaches, coastal dunes and barrier beaches are important to storm damage prevention and flood control. Coastal banks that, because of their height, provide a vertical buffer to upland areas from storm waters are significant to storm damage prevention and flood control. A particular coastal bank may serve both as a sediment source and as a vertical buffer, or it may serve only one role.

Coastal banks composed of unconsolidated sediment and exposed to wave action serve as a major source of sediment for other coastal landforms, including beaches, dunes and barrier beaches. The supply of sediment is removed from

banks by wave action. It is a naturally occurring process necessary to the continued existence of coastal beaches, coastal dunes and barrier beaches which, in turn, dissipate storm wave energy, thus protecting structures and coastal wetlands landward of them from storm damage and flooding.

Coastal banks, because of their height and stability, may act as a vertical buffer or a natural wall, which protects upland areas from storm damage and flooding. While erosion caused by wave action is an integral part of shoreline processes and furnishes important sediment to downdrift landforms, erosion of a coastal bank by wind and rain runoff, which plays only a minor role in beach nourishment, should not be increased unnecessarily. Therefore, disturbances to a coastal bank which reduce its natural resistance to wind and rain erosion cause cuts and gullies in the bank, increase the risk of its collapse, increase the danger to structures at the top of the bank, and decrease its value as a vertical buffer.

Vegetation tends to stabilize a coastal bank and reduce the rate of erosion due to wind and rain runoff. Any project permitted on a coastal bank should incorporate, when appropriate, elevated walkways.

(2) Definition:

“Coastal bank” means the seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action or storm flowage, or other wetland. Any minor discontinuity of the slope notwithstanding, the top of the bank shall be the first significant break in slope that occurs above the relevant 100 year flood plain elevation.

The 100 year flood plain elevation shall be taken from the latest available Flood Insurance Rate Maps, prepared by the Federal Emergency Management Agency for the Town of Yarmouth.

(3) Performance Standards: Any activity that is allowed on a coastal bank shall comply with the following provisions:

- (a) No new bulkhead, revetment, seawall, groin or other coastal engineering structure shall be permitted on a coastal bank that provides significant sediment to an adjacent or downdrift coastal beach; except that such a coastal engineering structure shall be permitted when required to prevent storm damage to buildings constructed prior to August 10, 1978, including re-construction of such buildings subsequent to the effective date of these regulations, provided that the following requirements are met:

- (1) coastal engineering structures or modifications thereto shall be designed and constructed so as to minimize, using best available measures, adverse effects on adjacent or nearby coastal beaches due to

changes in wave action;

- (2) the applicant demonstrates that no method of protecting the building other than the proposed coastal engineering structure is feasible;
- (3) protective planting designed to reduce erosion may be permitted; and
- (4) the applicant provides sufficient evidence that the building was constructed pursuant to a Notice of Intent prior filed before August 10, 1978.

- (b) Any project on a coastal bank or within 100 feet of the top of a coastal bank, other than a structure permitted under section 2.05, (3), (a), shall not have an adverse effect due to wave action on the movement of sediment from the coastal bank to coastal beaches or land subject to tidal action or flooding, and shall not have an adverse effect on the stability of a coastal bank.

2.06 Salt Marshes

(1) Preamble:

Salt marshes are important to the protection of wildlife, wildlife habitat, marine fisheries, prevention of pollution and are likely to be significant to storm damage prevention , flood control and groundwater supply.

A salt marsh produces large amounts of organic matter. A significant portion of this material is exported as detritus and dissolved organics to estuarine and coastal waters, where it provides the basis for a large food web that supports many marine organisms, including fin and shellfish. Salt marshes also provide a spawning and nursery habitat for several important estuarine forage finfish.

Salt marsh plants and substrate remove pollutants from surrounding waters. The network of salt marsh vegetation roots and rhizomes bind sediments together.

The sediments absorb chlorinated hydrocarbons and heavy metals such as lead, copper and iron. The marsh also retains nitrogen and phosphorus compounds.

The underlying peat also serves as a barrier between fresh groundwater landward of the marsh and the ocean, thus helping to maintain the level of groundwater.

Salt marsh cord grass and underlying peat are resistant to erosion and dissipate wave energy, thereby providing a buffer that reduces wave damage.

Land within 100 feet of a salt marsh is likely to be significant to the protection and maintenance of salt marshes, and therefore to the protection of the wetland values these areas contain.

The following characteristics of salt marshes are critical to one or more of the wetland values above:

- (a) the growth, composition and distribution of salt marsh vegetation;
- (b) the flow and level of tidal and fresh water; and
- (c) the presence and depth of peat.

(2) Definition:

- (a) "Salt Marsh" means a coastal wetland that extends landward up to the highest spring tide of the year, and is characterized by a plant community consisting of, but not limited to, 50% or more of any of the following species: Salt Meadow Cord Grass (*Spartina patens*); Salt Marsh Cord Grass (*Spartina alterniflora*); Spike Grass (*Distichlis spicata*); Sea Lavender (*Limonium nashii*); Seaside plantago (*Plantago juncooides*); Aster (*Aster subulatus*); Sea Blite (*Suaeda maritima*); Black Grass (*Juncus gerardi*); Samphire (*Salicornia europaea*); Glasswort (*S. bigelovii*); Reed Grass (*Phragmite communis*); Salt Marsh Bulrush (*Scirpus robustus*); or Narrow Leaf Cattail (*Typha* spp.).
- (b) "Spring Tide" means the tide of greatest amplitude during the approximately 14 day tidal cycle. It occurs at or near the time when the gravitational forces of the sun and moon are in phase, (new and full moons).

(3) Performance Standards: Any activity which is allowed on a salt marsh shall comply with the following provisions:

- (a) A proposed project in a salt marsh, on land within 100 feet from a salt marsh, or in a body of water adjacent to a salt marsh shall not destroy any portion of the salt marsh and shall not have an adverse effect on the productivity of the salt marsh. Alterations in growth, distribution and composition of salt marsh vegetation shall be considered in evaluating adverse effects on productivity.
- (b) Notwithstanding the provisions of section 2.06, (3), (a), a small project within a salt marsh, such as an elevated walkway or other structure which has no adverse effects other than blocking sunlight from the underlying vegetation for a portion of each day, may be permitted if such a project complies with all other applicable requirements of these regulations.
- (c) Notwithstanding the provisions of section 2.06, (3), (a), a project which will

restore or rehabilitate may be permitted; provided, however, that this section shall not be construed to allow the alteration of one salt marsh on a given site by or contingent upon the creation or restoration of another.

2.07 Land Under, or Within 100 Feet of the Banks of Salt Ponds

(1) Preamble:

Land under salt ponds is important to the protection of marine fisheries, wildlife, wildlife habitat, and where there are shellfish, to the protection of land containing shellfish.

Land under salt ponds provides an excellent habitat for marine fisheries. The high productivity of plants in salt ponds provides food for shellfish, crustaceans, and larval and juvenile fish. Salt ponds also provide spawning areas for shellfish and nursery areas for crabs and fish.

Characteristics of salt ponds critical to the protection of wetland values above are as follows:

- (a) water circulation;
- (b) distribution of sediment grain size;
- (c) freshwater inflow;
- (d) productivity of plants, and
- (e) water quality.

(2) Definition:

"Salt Pond" means a shallow enclosed or semi-enclosed body of saline water that may be partially or totally restricted by barrier beach formation. Salt ponds may receive fresh water from small streams emptying into their upper reaches and or small springs in the salt pond itself.

(3) Performance Standards: Any activity which is allowed on or under a salt pond or within 100 feet of the bank of a salt pond shall comply with the following provisions:

- (a) Any project on land under a salt pond, on land within 100 feet of the mean high water line of a salt pond, or on land under a body of water adjacent to a salt pond shall not have an adverse effect on the wildlife, wildlife habitat, marine fisheries or shellfish habitat of such a salt pond caused by:

- (1) alterations of water circulation;
 - (2) alterations in the distribution of sediment grain size and the relief or elevation of the bottom topography;
 - (3) modifications in the flow of fresh and or salt water;
 - (4) alterations in the productivity of plants, or
 - (5) alterations in water quality, including, but not limited to, other than normal fluctuations in the level of dissolved oxygen, nutrients, temperature or turbidity, or the addition of pollutants.
- (b) Notwithstanding the provisions of section 2.07 (3), activities specifically designed and intended to maintain the depth and the opening of a salt pond to the ocean in order to maintain or enhance marine fisheries or for the specific purpose of fisheries management, may be permitted at the sole discretion of the Commission.

2.08 Land Containing Shellfish

(1) Preamble:

Land containing shellfish is found within certain areas under the jurisdiction of the By-law. Shellfish are also specifically one of the wetland values in the By-law. The purpose of this section is to identify those areas likely to contain shellfish and to establish regulations for projects which will effect such land. Land containing shellfish is important to the protection of marine fisheries as well as to the protection of the interest of land containing shellfish.

Shellfish are a valuable renewable resource. The maintenance of productive shellfish beds not only assures the continuance of shellfish themselves, but also plays a direct role in supporting fish stocks by providing a major food source.

The following characteristics of land containing shellfish are critical to the protection of wetland values contained by such areas:

- (a) shellfish;
- (b) water quality;
- (c) water circulation; and
- (d) the natural relief, elevation or distribution of sediment grain size of such land.

(2) Definition:

- (a) "Land Containing Shellfish" means land under the ocean, tidal flats, salt marshes and land under salt ponds when any such land contains shellfish.
- (b) "Shellfish" means the following species: Bay scallop (*Aequipecten irradians*); Blue mussel (*Mytilus edulis*); Ocean quahog (*Artica islandica*); Oyster (*Crassostrea virginica*); Quahog (*Mercenaria mercenaria*); Razor clam (*Ensis directus*); Sea clam (*Spisula solidissima*); Sea scallop (*Placopecten magellanicus*); Soft shell clam (*Mya arenaria*); Lobster (*Homarus americanus*); Grass shrimp (*Hippolyte* spp.); Sand shrimp (*Crangon septemspinosa*); Blue crab (*Callinectes sapidus*); Green crab (*Carcinides maenas*); Fiddler crab (*Uca* spp.); Rock crab (*Cancer irroratus*).
- (3) Performance Standards: Except as provided in section 2.08, (4) and (5) below, any project on land containing shellfish shall not adversely affect such land or marine fisheries by a change in the productivity of such land caused by:
 - (a) alterations in water circulation;
 - (b) alteration in relief elevation;
 - (c) the compacting of sediment by vehicular traffic;
 - (d) alterations in the distribution of sediment grain size;
 - (e) Alterations in natural drainage from adjacent land, or
 - (f) changes in water quality, including, but not limited to, other than natural fluctuations in the levels of salinity, dissolved oxygen, temperature or turbidity, or the addition of pollutants.
- (4) The Conservation Commission may, after consultation with the shellfish constable, permit shellfish to be removed from such an area under the guidelines of and to a suitable location approved by the state Division of Marine Fisheries, (D.M.F.) in order to permit a proposed project on such land. Any such project shall not be commenced until after the moving and replanting of the affected shellfish has been completed.
- (5) Notwithstanding section 2.08, (3), projects approved by said D.M.F. that are specifically intended to increase the productivity of land containing shellfish may be permitted at the discretion of the Conservation Commission. Aquaculture projects approved by the appropriate local and state authorities may also be permitted at the discretion of the Conservation Commission.

2.09 Banks of or Land Under the Ocean, Ponds, Streams, Rivers, Lakes or Creeks that Underlie an Anadromous / Catadromous Fish Run (Fish Run)

(1) Preamble:

The banks of and land under the ocean, ponds, streams, rivers, lakes or creeks that underlie an anadromous / catadromous fish run are important to the protection of marine fisheries, wildlife, and wildlife habitat. Land within 100 feet of such banks is likely to be significant to the protection and maintenance of these banks, and therefore to the protection of the wetlands values these areas contain.

The following characteristics of a fish run, or the land under the ocean or pond, stream, river lake or creek that underlies a fish run are critical to the protection of those areas:

- (a) the fish;
- (b) accessibility of spawning areas;
- (c) the volume or rate of flow of water within spawning areas and migratory routes; ad
- (d) spawning and nursery grounds.

(2) Definition:

- (a) "Anadromous Fish" means fish that enter fresh water from the ocean to spawn, such as alewives, shad and salmon.
- (b) "Catadromous Fish" means fish that enter salt water from fresh water to spawn, such as eels.
- (c) "Anadromous/Catadromous Fish Run" means that area within estuaries, ponds, streams, creeks, rivers, lakes or coastal waters which is the spawning or feeding ground or passageway for anadromous or catadromous fish. Such fish runs shall include those areas which have historically served as fish runs and are either being restored or are planned to be restored at the time of the filing.

(3) Performance Standards: Any activity which is allowed on the bank of a fish run, land under a fish run, or land within 100 feet of a fish run shall comply with the following provisions:

- (a) Any project on such land or bank shall not have an adverse effect on the fish run by:
 - (1) impeding or obstructing the migration of the fish;
 - (2) impeding the volume or rate of flow of water within the fish run; or

- (3) impairing the capacity of spawning or nursery habitats necessary to sustain the various life stages of the fish.

(b) Filling in a fish run shall be prohibited.

2.10 Land Subject to Coastal Storm Flowage

(1) Preamble:

Land subject to coastal storm flowage are areas subject to coastal flooding during moderate and severe weather conditions. Projects that occur within these areas are likely to have adverse impacts on the following interests:

- (a) Flood Control
- (b) Storm Damage Prevention
- (c) Prevention of Pollution
- (d) Public Water Supply
- (e) Private Water Supply
- (f) Land Containing Shellfish
- (g) Wildlife
- (h) Wildlife Habitat
- (i) Protection of Groundwater Supply and Quality
- (j) Protection of Fisheries

Land subject to coastal storm flowage has the potential to provide Yarmouth a profound service.

When coastal conditions are not the norm during extreme high tides and hurricanes for example, the ability of the land to absorb flood waters and to buffer more inland areas from flood and wave damage is imperative.

Since the floodplain contains areas, (as well as other wetland resources), in which the water table is close to the surface, during a coastal storm, pollutants in the floodplain, including the contents of septic systems and fuel tanks, are likely to affect public and private water supply, groundwater quality, wildlife and wildlife habitat, fisheries and shellfish. Storm damage prevention, as one of the interests

protected under the By-law, also come into play in the floodplain. Direct and collateral damage can occur to man made structures in the floodplain area caused by wave impacts and inundation by floodwaters and storm driven debris.

(2) Definition:

“Land Subject to Coastal Storm Flowage” are areas that extend up-gradient or landward from the ocean and the ocean’s estuaries to a point where the maximum lateral extent of floodwater will theoretically terminate based upon the 100 year frequency storm. Said boundary shall be the relevant 100 year storm elevation referenced within the latest available Flood Insurance Rate Maps provided by the Federal Emergency Management Agency.

(3) Performance Standards: Any activity within land subject to coastal storm flowage which will result in the building upon, removing, filling or altering land within 300 feet of a major estuary defined in section 1.04 of these regulations shall meet the following requirements. Notwithstanding this section 2.10, (3), beach nourishment and coastal engineering projects such as bulkheads and seawalls may be allowed if they meet all other performance in these regulations.

- (a) Existing septic system and cesspool repairs will be allowed provided they substantially meet all Title 5 and local Board of Health thresholds.
- (b) All groundwater elevations shall incorporate seasonable adjustments if test holes and or leaching components are 100 feet or closer from major estuaries.
- (c) Any proposed deck, shed, or other similar structure must be securely anchored to a footing or foundation.

2.11 Coastal Watershed Areas

(1) Preamble:

- (a) Coastal watershed areas are wetland and upland landforms that contribute surface and sub-surface water to the estuaries within the town. The quality of the surface and sub-surface water is deemed to be critical to the following interests:

- (1) Protection of public and private water supply
- (2) Groundwater and groundwater quality
- (3) Water quality within the numerous ponds of the town
- (4) Wildlife and wildlife habitat

(5) Protection of Land Containing Shellfish

(6) Protection of Fisheries

(7) Recreation

(b) There are presently several land use practices that present serious threats to the quality of our Coastal Watershed Areas. These include but are not limited to the following:

(1) Outdated underground storage tanks

(2) Landfills

(3) Stump dumps

(4) Road salt storage

(5) Septic package treatment plants

(6) Automotive and construction equipment repairs.

(2) Definition:

“Coastal Watershed Areas” are those areas mapped and delineated specifically within the “Water Resources Protection Study” prepared for the Town of Yarmouth by I.E.P. Inc. and Wright Pierce, dated August, 1988. For the purposes of this section 2.11, (2), Conservation Commission jurisdiction will be restricted to within 300 feet from a major estuary defined in section 1.04, and such jurisdiction must occur within the mapped area referenced above.

(3) Performance Standards: In order to properly protect our Coastal Watershed Areas, no project will be allowed that incorporates any of the practices referenced in section 2.11, (1), (b), 1 thru 6.

2.12 Rocky Intertidal Shores

(1) Preamble:

Rocky intertidal shores are likely to be significant to storm damage prevention, flood control, protection of marine fisheries and wildlife habitat and where there are shellfish, protection to land containing shellfish.

Rocky shore environments are habitats for macroalgae and marine invertebrates and provide protection to and food for, larger marine organisms such as crabs, lobsters, and such fish species as winter flounder, as well as a number of birds.

Most marine plants and animals found in rocky shore environments are uniquely adapted to survive there and cannot survive elsewhere. Harbor seals also use rocky intertidal shores, such as rock outcroppings or isolated shores of small islands, as haul out areas.

Where a proposed project involves the filling, removing or altering of a rocky intertidal shore, the issuing authority shall presume that such shore is significant to the interests specified above. This presumption may be overcome only upon a clear showing that a rocky intertidal shore does not play a role in storm damage prevention, flood control, protection of marine fisheries or wildlife habitat, and where there are shellfish, protection of land containing shellfish and if the issuing authority makes a written determination to such effect.

When a rocky intertidal shore is determined to be significant to storm damage prevention, flood control, or protection of wildlife habitat, the form and volume of exposed intertidal cobbles and boulders are critical to the protection of those interests.

When a rocky intertidal shore is significant to the protection of marine fisheries or wildlife habitat, water circulation and water quality are critical to the protection of those interests.

(2) Definition:

Rocky intertidal shores means naturally occurring rocky areas such as cobbles or boulder-strewn areas between the mean high water line and the mean low water line.

(3) Performance Standards: When a rocky intertidal shore is determined to be significant to storm damage prevention, flood control, or protection of wildlife habitat, any proposed project shall be designed and constructed using the best practical measures so as to minimize adverse effects on the form and volume of exposed intertidal cobbles and boulders.

When a rocky intertidal shore is determined to be significant to the protection of marine fisheries or wildlife habitat, any proposed project shall, if water dependent, be designed and constructed using the best available measures, so as to minimize adverse effects, and if non-water dependent, have no adverse effects on water circulation and water quality. Water quality impacts include, but are not limited to, other than natural fluctuations in the levels of dissolved oxygen, temperature or turbidity, or the addition of pollutants.

PART 3. REGULATIONS FOR INLAND WETLANDS

3.01 Inland Banks and Beaches

(1) Preamble:

Banks are likely to be significant to wildlife, wildlife habitat, public or private water supply, groundwater supply, flood control, storm damage prevention, prevention of pollution and protection of fisheries. Where banks are composed of concrete, asphalt, or other artificial impervious material, said banks are likely to be significant to flood control and storm damage prevention.

Banks are areas where groundwater discharges to the surface and where, under some circumstances, surface water recharges to the groundwater.

Where banks are partially or totally vegetated, the vegetation serves to maintain the bank's stability, which in turn protects water quality by reducing erosion and siltation.

Banks act to confine floodwaters during most storms, preventing the spread of water to adjacent land.

Land within 100 feet of a bank is likely to be significant to the protection and maintenance of the bank, and therefore to the protection of the interests which these resource areas protect.

(2) Definition, Critical Characteristics and Boundary

- (a) A bank is that portion of land surface which normally abuts and confines a water body. A bank may be partially or totally vegetated, or it may be comprised of exposed soil, gravel, stone or sand.
- (b) The physical characteristics of a bank, as well as its location, in the foregoing section, 3.01, (2), (a), are critical to the protection of the interests specified in section 3.01, (1).
- (c) The upper boundary of a bank is the first observable break in slope above the mean annual flood level. The lower boundary of a bank is the mean annual low flow level.

(3) Performance Standards: Any proposed work permitted by the Commission on a bank, or within 100 feet of the upper boundary of a bank, shall not impair the following:

- (a) the physical stability of the bank;

- (b) the water carrying capacity of the existing channel within the bank;
 - (c) groundwater and surface water quality; and
 - (d) the capacity of the bank to provide breeding habitat, escape cover and food for fisheries and wildlife.
- (4) No more than 50 linear feet of a bank may be altered if it is providing breeding habitat, escape cover and food for fisheries and wildlife.

3.02 Vegetated Wetlands, (Wet Meadows, Marshes, Swamps and Bogs)

(1) Preamble:

Vegetated Wetlands are likely to be significant to wildlife, wildlife habitat, public or private water supply, groundwater supply, flood control, storm damage prevention, prevention of pollution, protection of fisheries, and protection of shellfish.

The plant communities, soils and associated low, flat topography of vegetated wetlands remove or detain sediments, nutrients such as nitrogen and phosphorous and toxic substances such as heavy metal compounds that occur in runoff and flood waters.

Some nutrients and toxic substances are detained for years in plant root systems or in the soils. Others are held by plants during the growing season and released as the plants decay in the fall and winter. This later phenomenon delays the impacts of nutrients and toxins until the cold weather periods, when such impacts are less likely to reduce water quality.

Vegetated wetlands are areas where groundwater discharges to the surface and where, under some circumstances, surface water discharges to the groundwater.

The profusion of vegetation and the low, flat topography of vegetated wetlands slow down and reduce the passage of flood waters during peak flows by providing temporary flood water storage, and by facilitating water removal through evaporation and transpiration. This reduces downstream flood crests and resulting damage to private and public property. During dry periods, the water retained in vegetated wetlands is essential to the maintenance of base flow levels in the rivers and streams, which in turn is important to the protection of water quality and water supplies.

Wetland vegetation provides shade that moderates water temperatures important to fish life. Vegetated wetlands flooded by adjacent water bodies and waterways provide food, breeding habitat and cover for fish. Fish populations in the larval stage are particularly dependent upon food provided by over the bank flooding

which occurs during peak flow periods, (extreme storms), because most river and stream channels do not provide quantities of the microscopic plant and animal life required for survival.

Wetland vegetation supports a wide variety of insects, reptiles, amphibians, mammals, and birds which are a source of food for important game fish. Bluegills (*Lepomis macrochirus*), pumpkinseeds (*Lepomis gibbosus*), yellow perch (*Perca flavescens*), rock bass (*Ambloplites rupestris*) and all trout species feed upon non-aquatic insects. Largemouth bass (*Micropterus salmoides*), chain pickerel (*Esox niger*) and northern pike (*Esox lucius*) feed upon small mammals, snakes, non-aquatic insects, birds and amphibians.

Vegetated wetlands, together with land within 100 feet of a vegetated wetland, serve to moderate and alleviate thermal shock and pollution resulting from runoff which may be detrimental to wildlife, fisheries and shellfish downstream of the vegetated wetland.

The maintenance of base flows by vegetated wetlands is likely to be significant to the maintenance of proper salinity ratios in estuarine areas downstream of the vegetated wetland. A proper salinity ratio, in turn, is essential to the ability of shellfish to spawn successfully, and therefore to provide for the continuing propagation of shellfisheries.

Land within 100 feet of a vegetated wetland is likely to be significant to the protection and maintenance of vegetated wetlands, and therefore to the protection of the interests which these resource areas serve to protect.

(2) Definition, Critical Characteristics and Boundary

- (a) Vegetated wetlands are brackish and freshwater wetlands. The types of brackish and freshwater wetland are wet meadows, marshes, swamps and bogs. They are areas where the topography is low and flat, and where soils are annually saturated. The ground and surface water regime and the vegetational community which occur in each type of freshwater wetland are specified in section 3.02, (2), (c).
- (b) The physical characteristics of vegetated wetlands, as described in the foregoing section 3.02, (2), (a), are critical to the protection of the interests specified in section 3.02, (1), above.
- (c) The boundary of a vegetated wetland is the line within which 50% or more of vegetational community consists of the wetland plant species identified in sections 3.02, (1) thru 3.02, (2), (c), (4), below. A minimum size of 3000 square feet is required for jurisdiction under these regulation.

- (1) The term “bogs” in this section shall mean areas where standing or slowly running water is near or at the surface during the normal growing season and where a vegetational community has a significant portion of the ground water or surface covered with sphagnum moss, (Sphagnum), and where the vegetational community is made up of a significant portion of one or more of, but not limited to nor necessarily all, of the following plants or groups of plants: aster (*Aster nemoralis*), azaleas (*Rhododendron canadense* and *R. viscosum*), black spruce (*Picea mariana*), bog cotton (*Eriophorum*), cranberry (*Vaccinium macrocarpon*), high bush blueberry (*Vaccinium corymbosum*), larch (*Larix laricina*), laurels (*Kalmia augustifolia* and *K. polifolia*), leatherleaf (*Chamaedaphne calyculata*), orchids (*Arethusa*, *Calopogon*, *Pogonia* spp.) pitcher plants (*Sarracenia purpurea*), sedges (*Cyperaceae*), sundews (*Droseraceae*), sweet gale (*Myrica gale*), white cedar (*Chamaecyparis thyoides*).
- (2) The term “swamps” as used in this section shall mean areas where ground water is at or near the surface of the ground for a significant part of the growing season or where runoff water from surface drainage frequently collects above the soil surface, and where a significant part of the vegetational community is made up of, but not limited to, nor necessarily include all of the following plants or groups of plants: alders (*Alnus*), ashes, (*Fraxinus*), azaleas (*Rhododendron canadense* and *R. viscosum*), black alder (*Ilex verticillata*), black spruce (*Picea mariana*), button bush (*Cephalanthus occidentalis*), American or white elm (*Ulmus americana*), white hellebore (*Veratrum viride*), hemlock (*Tsuga canadensis*), high bush blueberry (*Vaccinium corymbosum*), larch (*Larix laricina*), cowslip (*Caltha palustris*), poison sumac (*Vernix toxicodendron*), red maple (*Acer rubrum*), skunk cabbage (*Symplocarpus foetidus*), sphagnum moss (*Sphagnum*), spicebush (*Lindera benzoin*), tupelo (*Nyssa sylvatica*), sweet pepper bush (*Clethra alnifolia*), white cedar (*Chamaecyparis thyoides*), willow (*Salicaceae*), common reed (*Phragmite communis*).
- (3) The term “wet meadows” as used in this section is where groundwater is at the surface for a significant part of the growing season and near the surface throughout the year and where a significant part of the vegetational community is comprised of various grasses, sedges and rushes; made up of, but not limited to nor necessarily including all of the following plants or groups of plants: blue flag (*Iris*), vervain (*Verbena*), thoroughwort (*Eupatorium*), dock (*Rumex*), false loosestrife (*Ludwigia*), hydrophytic grasses (*Gramineae*), loosestrife (*Lythrium*), marsh fern (*Dryopteris thelypteris*), rushes (*Juncaceae*), sedges (*Cyperaceae*), sensitive fern (*Onclea sensibilis*), smartweeds (*Polygonum*), jewelweed (*Impatiens capensis*).

- (4) The term “marshes” as used in this section shall mean areas where a vegetational community exists in standing or running water during the growing season and where a significant part of the vegetational community is comprised of, but not limited to nor necessarily including all of the following plants or groups of plants: arums (Araceae), bladder-worts (Utricularia), bur-reeds (Sparganiaceae), button bush, (Cephalanthus occidentalis), cattails (Typha), duck weeds (Lemnaceae), eelgrass (Vallisneria), frog’s bit (Hydrocharitaceae), horsetails (Equisetaceae), hydrophytic grasses (Gramineae), leather-leaf (Chamaedaphne calyculata), pickerel weeds (Pontederiaceae), pipeworts (Eriocaulon), pond weeds (Potamogeton), rushes (Juncaceae), sedges (Cyperaceae), smartweeds (Polygonum), sweet gale (Myrica gale), water milfoil (Haloragaceae), water lilies (Nymphaeaceae), water startworts (Callitrichaceae), water willow (Decodon verticillatus).

- (3) Performance Standards: Any proposed work, permitted by the Commission, in a vegetated wetland or within 100 feet of a vegetated wetland shall not destroy any portions of said vegetated wetland, nor shall the proposed work impair in any way the vegetated wetland’s ability to perform any of the functions in section 3.02, (1).

3.03 Land Under Water Bodies, (under any creek, river, stream pond or lake, flats or ditch)

(1) Preamble:

Land Under Water Bodies and Waterways is likely to be significant to wildlife, wildlife habitat, public and private water supply, groundwater supply, flood control, storm damage prevention, prevention of pollution and protection of fisheries. Where Land Under Water Bodies and Waterways is composed of pervious material, such land represents a point of exchange between surface and groundwater.

The physical nature of Land Under Water Bodies and Waterways is highly variable, ranging from deep organic and fine sedimentary deposits to rocks and boulders. The organic soils and sediments play an important role in the process of detaining and removing dissolved and particulate nutrients, (such as nitrogen and phosphorous), from the surface water above. They also serve as traps for toxic substances (such as heavy metal compounds). Land Under Water Bodies and Waterways, in conjunction with banks, serves to confine flood water within a definite channel during the most frequent storms. Filling within this channel blocks flows which in turn causes backwater and over bank flooding during such storms. An alteration of Land Under Water Bodies and Waterways that causes

water to frequently spread out over a larger area at a lower depth increases the amount of property which is routinely flooded. Additionally, it results in an elevation of water temperature and a decrease of habitat in the main channel, both of which are detrimental to fisheries, particularly during periods of warm weather and low flows.

Land under ponds and lakes is vital to a large assortment of warm water fish during spawning periods. Species such as largemouth bass, bluegills, pumpkinseeds, black crappie and rock bass build their nests on the lake bottom substrates within which they shed and fertilize their eggs.

Land within 100 feet of any bank abutting land under a water body is likely to be significant to the protection and maintenance of land under a water body, and therefore to the protection of the interests which these water bodies serve to protect.

(2) Definition, Critical Characteristics and Boundary

- (a) Land Under Water Bodies is the land beneath any creek, river, stream, pond, lake or ditch. Said land may be composed of muck or peat, fine sediments, gravel or rock.
- (b) The physical characteristics and location of Land Under Water Bodies and Waterways specified in the foregoing subsection 3.03, (2), (a) are critical to The protection of the interests specified in section 3.03, (1) above.
- (c) The upper boundary of Land Under Water Bodies is the mean annual low water level.

(3) Performance Standards: Any proposed work, permitted by the Commission, on land under a water body shall not impair the following:

- (a) The water carrying capacity within the defined channel, which is provided by said land in conjunction with adjacent banks;
- (b) Ground and surface water quality; and
- (c) The capacity of said land to provide breeding habitat, escape cover and food for fisheries and wildlife.

3.04 Land Subject to Flooding, (both Bordering and Isolated areas)

(1) Preamble:

- (a) Bordering Land Subject to Flooding:

Bordering Land Subject to Flooding is an area which floods from a rise in a bordering waterway or water body. Such areas are likely to be significant to flood control, storm damage prevention, wildlife and wildlife habitat.

Bordering Land Subject to Flooding provides a temporary storage area for flood water which has overtopped the bank of the main channel of a creek, river or stream or the basin of a pond or lake. During periods of peak runoff, flood waters are retained, (e.g., slowly released through surface discharge) by Bordering Land Subject to Flooding. Over time, incremental filling of these areas causes increases in the extent and level of flooding by eliminating flood storage volume or by restricting flows, thereby causing increases in damage to public and private properties.

(b) Isolated Land Subject to Flooding:

Isolated Land Subject to Flooding is an isolated depression or a closed basin which serves as a ponding area for runoff or high groundwater which has risen above the ground surface. Such areas are likely to be locally significant to flood control, storm damage prevention, wildlife and wildlife habitat. In addition, where such areas are underlain by pervious materials, they are likely to be significant to public or private water supply. Finally, where such areas are underlain by pervious material covered by a mat of organic peat and muck, they are also likely to be significant to the prevention of pollution.

Isolated Land Subject to Flooding provides a temporary storage area where runoff and high ground water pond and slowly evaporate or percolate into the substrate. Filling causes lateral displacement of the ponded water onto contiguous properties, which may in turn result in damage to said properties.

Isolated Land Subject to Flooding, where it is underlain by pervious material, provides a point of exchange between ground and surface waters. Contaminates introduced into said area, such as septic system discharges and road salts, find easy access into the ground water and neighboring wells. Where these conditions occur and a mat of organic peat or muck covers the substrate of the area, said mat serves to detain and remove contaminants which might otherwise enter the ground water and neighboring wells.

(2) Definition, Critical Characteristics and Boundaries

(a) Bordering Land Subject to Flooding

- (1) "Bordering Land Subject to Flooding" is an area with low, flat topography adjacent to an inundated by flood waters rising from creeks, rivers, streams, ponds, lakes or water courses. It extends from the banks of these waterways and water bodies; where a vegetated wetland occurs, it extends from said wetland.

- (2) The topography and location of Bordering Land Subject to Flooding specified in the foregoing section 3.04, (2), (a), (1) are critical to the protection of the interests specified in section 3.04, (1), (a).
- (3) The boundary of Bordering Land Subject to Flooding is the estimated maximum lateral extent of flood water which will theoretically result from the statistical 100 year frequency storm. Said boundary shall be that determined by reference to the most recently available flood profile data prepared for the community within which the work is proposed under the National Flood Insurance Program, (NFIP, currently administered by the Federal Emergency Management Agency, successor to the U. S. Department of Housing and Urban Development. Said boundary, so determined, shall be presumed accurate. This presumption may be overcome only by credible evidence from a registered professional engineer or other professional competent in such matters. Where NFIP profile data is unavailable, the boundary of Bordering Land Subject to Flooding shall be the maximum lateral extent of flood water which has been observed or recorded.

(b) Isolated Land Subject to Flooding:

- (1) Isolated Land Subject to Flooding is an isolated depression or closed basin without an inlet or an outlet. It is an area which at least once a year confines standing water. Isolated Land Subject to Flooding may be underlain by pervious material, which in turn may be covered by a mat of organic peat or muck.
 - (2) The characteristics specified in the foregoing section, 3.04, (2), (b), (1) are critical to the protection of the interests specified in 3.04, (1), (b) above.
 - (3) The boundary of Isolated Land Subject to Flooding is the perimeter of the largest observed or recorded volume of water confined in said area. A minimum size of 3000 square feet is required for jurisdiction under these regulations.
- (3) Performance Standards: Any proposed work, permitted by the Commission, on land subject to flooding shall not result in the following:
- (a) Flood damage due to filling which causes lateral displacement of water that would otherwise be confined within said area.
 - (b) An adverse effect on public and private water supply or ground water supply, where said area is underlain by pervious material.

- (c) An adverse effect on the capacity of said area to prevent pollution of the ground water, where the area is underlain by pervious material, which in turn is covered by a mat of organic peat or muck.
- (d) An adverse effect on wildlife or wildlife habitat.
- (e) An adverse effect on state listed rare and endangered vertebrates and invertebrates as identified by M.D.F.W., (Mass Division of Fisheries and Wildlife).

3.05 Lake and Pond Recharge Areas

(1) Preamble:

- (a) Lake and Pond Recharge Areas are wetland and upland landforms that contribute surface and subsurface water to the lakes and ponds of the Town. The Quality of the surface and subsurface water is deemed to be critical to the following interests:
 - (1) Protection of public and private water supply;
 - (2) Ground water and ground water quality;
 - (3) Water quality within the numerous ponds and lakes of the Town;
 - (4) Wildlife and wildlife habitat;
 - (5) Protection of land containing shellfish;
 - (6) protection of fisheries; and
 - (7) Recreation
- (b) There are presently several land use practices that present serious threats to the quality of our lake and pond recharge areas. These include but are not limited to the following:
 - (1) Outdated underground storage tanks;
 - (2) Landfills;
 - (3) Stump dumps;
 - (4) Road salt storage;
 - (5) Package treatments plants, (septage); and

(6) Automotive and construction equipment repairs.

(2) Definition:

(a) Lake and Pond Recharge Areas are those areas specifically delineated and mapped by the "Water Resources Protection Study" prepared for the Town of Yarmouth by I.E.P. Inc. and Wright Pierce, dated August, 1988. For purposes of this section, 3.05, (2), (a), Conservation Commission jurisdiction will be restricted to within 300 feet from any lake or pond and such jurisdiction must occur within the mapped area referenced above.

(b) Performance Standards: In order to properly protect our Lake and Pond Recharge Areas, no project will be allowed that incorporates any of the practices referenced in section 3.05, (1), (b), (1thru6) of these regulations.

Part 4 Variance

4.01 **Text**

(1) The Conservation Commission may at its discretion, waive one or more of these regulations when the proposed work potentially represents a significant ecological improvement when compared to existing conditions, or will adversely affect any areas subject to the protection of these regulations. In addition, the Conservation Commission may, at its discretion, waive one or more of these regulations when there is an overriding public safety issue at hand and there is no feasible alternative to the proposed work.

Appendix 4

Local Historic By-Laws

Chapter 92: HISTORIC PROPERTIES

[HISTORY: Adopted by the Special Town Meeting of the Town of Yarmouth 8-30-1989 by Art. 14. Amendments noted where applicable.]

§ 92-1. Intent and scope.

This chapter is enacted to promote the public welfare and to safeguard the Town's historical, cultural and architectural heritage by protecting historic resources that make the Town a more interesting, attractive and desirable place in which to live. The intent is to protect and preserve historic properties by encouraging their owners to seek alternatives to demolition.

§ 92-2. Definitions.

As used in this chapter, the following words and terms, unless the context requires otherwise, shall have the following meanings:

BUILDING — Any combination of materials forming a shelter for persons, animals or property.

COMMISSION — The Yarmouth Historical Commission.

DEMOLITION — Any act of destroying, elimination, pulling down, razing or removing a building or any portion thereof or starting the work of any such act with the intention of completing the same.

PERSON — Any actual person, firm, partnership, association or corporation.

SIGNIFICANT BUILDING — Any building or portion thereof which is not within a regional historic district, subject to regulation under the provisions of MGL c. 40C and has been listed or is the subject of a pending application for listing on the National Register of Historic Places or has been listed on the Massachusetts Register of Historic Places or is over 75 years of age and:

- A. Is associated with one or more historic persons or events contributing to the cultural, political, economic or social history of the Town or the commonwealth; or
- B. Is historically or architecturally important (in terms of period, style, method of building construction or association with a famous architect or builder), either by itself or in the context of a group of buildings.

§ 92-3. Procedure.

- A. No permit for the demolition of a building shall be issued other than in conformity with the provisions of this chapter as well as in conformity with provisions of other laws applicable to the demolition of buildings and the issuance of permits therefor generally.
- B. When an application is made for a demolition permit at the Building Department, the applicant shall deliver a copy of said application, signed by the owner of record at the time of application, to the Historical Commission.
- C. The Commission, within seven business days of the receipt of the application, shall determine the significance of said building. When said building is determined to be a significant building, in accordance with the criteria set forth in the definition of "significant building" in § 92-2, the Commission shall notify, in writing, the Building Commissioner, the Town Clerk and, by certified mail, the owner of record as indicated on the application.

- D. The Commission shall hold a public hearing on said significant building application within 30 days after the date it is filed with the Town Clerk and shall give notice thereof by publishing the date, time and place and purpose of the hearing in a local newspaper at least 14 days before such hearing and also within seven days of said hearing and shall mail a copy of said notice to the applicant. The Commission may also require that the applicant maintain on said significant building a notice in a form designated by the Commission, visible from the nearest public way, of any hearing upon subject matter of such application.
- E. The Commission shall notify the applicant, the Building Commissioner and the Town Clerk within 10 days from the close of the public hearing if the Commission determines that the demolition of the significant building would not be detrimental to the historical, cultural or architectural heritage or resources of the Town. The Building Commissioner may, subject to the requirements of the State Building Code and any other applicable laws, bylaws, rules and regulations, issue the demolition permit.
- F. The Commission shall notify the applicant, the Building Commissioner and the Town Clerk within 10 days from the close of the public hearing if the Commission determines that the demolition of the significant building would be detrimental to the historical, cultural or architectural heritage or resources of the town, and no demolition permit may be issued until at least 60 days after the date of such determination by the Commission.
- G. The Building Commissioner may issue a demolition permit for the significant building which is the subject of said hearing at any time after receipt of written advice from the Commission to the effect that either:
 - (1) The Commission is satisfied that there is no reasonable likelihood that either the owner or some other person or group is willing to purchase, preserve, rehabilitate or restore such building; or
 - (2) The Commission is satisfied that for at least 60 days the owner has made continuing, bona fide and reasonable efforts to locate a purchaser to preserve, rehabilitate or restore the subject building and that such efforts have been unsuccessful.

§ 92-4. Emergency demolitions.

Nothing in this chapter shall restrict the Building Commissioner from ordering the demolition of a significant building determined by him to present a danger to the safety of the public which only demolition can prevent.

§ 92-5. Violations and penalties.

- A. Whoever violates any provision of this chapter shall be penalized by a fine of not more than \$300.
- B. The Commission and the Building Commissioner and/or his assignees are each authorized to institute any and all proceedings in law or equity as they deem necessary to obtain compliance with the requirements of this chapter or to prevent a violation thereof.

§ 92-6. Severability.

If any section, paragraph or part of this chapter is for any reason declared invalid or unconstitutional by any court, every other section, paragraph and part shall continue in full force and effect.

§ 92-7. Conflicts with other legislation.

No provision of this chapter shall be construed or applied so as to conflict with MGL c. 143. In the event of any apparent conflict, the provisions of MGL c. 143 shall prevail.

TOWN OF DENNIS

BY-LAW

SOUTH DENNIS HISTORIC DISTRICT

AND

HISTORIC DISTRICT COMMISSION BY-LAW

Section 1. Purpose - The purpose of this act is to promote the educational, cultural, economic and general welfare of the public through the preservation and protection of buildings and places in a district of historic, cultural or literary significance through the development and maintenance of appropriate settings and appearance of such buildings and to preserve and maintain such district as a landmark compatible with the historic, cultural and literary tradition of the Town of Dennis and as a reminder of old South Dennis as it existed in the early days of Cape Cod.

Section 2. - Establishment of the District - There is hereby established in the Town of Dennis a district to be known as the South Dennis Historic District, hereinafter called the District, as shown on a plan with the Town Clerk.

Section 3. - Definitions - As used in this act, the following words and terms shall have the following meanings:

"Building inspector" - the Building Inspector of the Town of Dennis.

"Exterior architectural feature" - the architectural style and general arrangement of such portion of the exterior of a structure as is designed to be open to view from a public way or public place, including kind, color and texture of the building materials of such portion, and type of all windows, doors, lights, signs and other fixtures appurtenant to such portion.

"Building" - a combination of materials having a roof and forming a shelter for persons, animals, or property. This includes artificial pools or ponds.

"Erected" - shall include the words "built", "constructed", "reconstructed", "restored", "altered", "enlarged" and "maintained".

"Structure" - a combination of materials other than a building, sign or billboard, but including stone walls and fences.

Section 4. Establishment and Organization of the South Dennis Historic District Commission - There is hereby established the South Dennis Historic District Commission under the provisions of the General Laws, Chapter 40C, hereinafter called the Commission, consisting of five members, appointed by the Selectmen, including one member, where possible, from two nominees of the Dennis Historical Society, one member, where possible, from two nominees of the Massachusetts State Chapter of the American Institute of Architects, and one member,

where possible, from two nominees of the Cape Cod Board of Realtors. One or more members shall be residents of the District. The Selectmen shall annually appoint one person residing in the District to serve as an alternate member who may, upon designation by the Chairman of the Commission, sit as a member in order to establish a quorum during Commission meetings.

When the Commission is established, one member shall be appointed for a term of one year, two shall be appointed for a term of two years, and two shall be appointed for a term of three years, and their successors shall be appointed in like manner for terms of three years.

Any vacancy occurring before the end of the term of any member shall be filled by the Selectmen by appointment for the remainder of the unexpired term.

The Commission shall elect a chairman, a vice-chairman, and a secretary from its membership. In the case of the absence of the chairman from any meeting, the vice-chairman shall preside.

Three members of the Commission shall constitute a quorum.

Any member may be removed for cause by the Selectmen of the Town of Dennis upon written charges and after a public hearing.

Section 5. Limitations - No building, structure or part thereof, except as provided under section six, shall be erected within the District unless and until an application for a certificate of appropriateness as to the exterior architectural features, shall have been filed with the Commission and either a certificate of appropriateness, or a certificate that no exterior architectural feature is involved, shall have been issued by the Commission.

No building, structure or any part thereof within the District, except as provided under section six, shall be demolished or removed unless and until an application for a certificate to demolish or remove the same shall have been filed with the Commission, and such certificate shall have been issued by the Commission.

No occupational, commercial or other sign, except as provided under section six, and no billboard shall be erected or displayed on any lot or the exterior of any building or structure within the District unless and until an application for a certificate of appropriateness shall have been filed with the Commission, and such certificate shall have been issued by the Commission. In the case of any such sign or billboard erected or displayed prior to the effective date of this act, there shall be allowed a period of five years, subsequent to said effective date, in which to obtain such certificate.

Except in cases excluded by section six, no permit shall be issued by the building inspector for

any building or structure to be erected within the District, unless the application for said permit shall be accompanied either by a certificate of appropriateness or a certificate that no exterior architectural feature is involved, has been issued under section nine.

No permit shall be issued by the building inspector for the demolition or removal of any building or structure within the District unless the application for said permit shall be accompanied by a certificate issued under section nine.

Section 6. Exclusions - Nothing in this act shall be construed to prevent the ordinary maintenance and such repairs as do not change any exterior architectural feature of any building or structure within the District; nor shall anything in this act be construed to prevent the erection, construction, reconstruction, restoration, alteration or demolition of any such existing feature which the building inspector shall certify is required by the public safety because of an unsafe or dangerous condition; nor shall anything in this act be construed to prevent the erection, construction, reconstruction, restoration, alteration or demolition of any such feature under a permit issued by the building inspector prior to the effective date of this act.

The following structures and signs may be erected or displayed within the District without the filing of an application for, or the issuance of a certificate of appropriateness:

1. Temporary structures or signs for use in connection with any official celebration or parade or any charitable drive in the Town of Dennis; provided that any such structure or sign shall be removed within three days following the termination of the celebration, parade or charitable drive for which said structure or sign shall have been erected or displayed. Any other temporary structures or signs which the Commission shall determine do not substantially derogate from the intent and purposes of this act may from time to time be excluded from the provisions of section five.
2. Real estate signs of not more than three square feet in area advertising the sale or rental of the premises on which they are erected or displayed.
3. Occupational signs of not more than one square foot in area and not more than one such sign, irrespective of size, bearing the name, occupation or address of the occupant of the premises on which such sign is erected or displayed where such premises are located within an R-20 one family dwelling district as defined in the Zoning By-laws of the Town of Dennis.
4. Open picket, rail, split rail or other types of fences which the Commission may from time to time deem suitable, not exceeding four feet (4'0") in height, above the finished grade.

The exterior color of any building or structure within the District may be changed to white without the filing of an application for, or the issuance of, a certificate of appropriateness or to

any color or any combination of colors which the Commission shall determine from time to time may be used without substantial derogation from the intent and purposes of this act.

Section 7. Application to be filed with Commission - Excepting cases excluded by section six, any person, including the Town of Dennis, who desires to erect, move or demolish or remove or change the exterior color features of any building or structure within the District, or to erect or display within the district any sign or billboard for which a certificate of appropriateness is required under section five, shall file with the Commission an application for a certificate of appropriateness or a certificate for demolition or removal, as the case may be, together with such plans, elevations, specifications, material and other information as shall be deemed necessary by the Commission to enable it to make a determination on the application.

Section 8. Meetings, Hearings, Time for Making Determinations - Meetings of the Commission shall be held at the call of the Chairman and also when called in such other manner as the Commission shall determine by its rules.

The Commission shall determine promptly after the filing of an application for a certificate of appropriateness as to the exterior architectural features, whether the application involves any such features. If the Commission determines that such application involves any exterior architectural features, the Commission shall hold a public hearing thereon.

The Commission shall fix a reasonable time for the hearing on any application and shall give public notice thereof by publishing notice of the time, place and purpose of the hearing in a local newspaper at least fourteen days before said hearing and also, not less than seven days prior to said hearing, mail a copy of said notice to the applicant, to owners of the property abutting the premises to be affected as they appear on the most recent local tax list, to the planning board of the town, and to such other persons as the Commission shall deem entitled to notice.

As soon as convenient after such public hearing, but in any event within sixty days after the filing of the application, or within such further time as the applicant shall allow in writing, the Commission shall make a determination on the application. If the Commission shall fail to make a determination within said sixty days or within such further time allowed by the applicant, the Commission shall be deemed to have approved the application.

Section 9. Powers, Functions and Duties of the Commission - The Commission shall pass upon:

- a) The appropriateness of exterior architectural features of buildings and structures to be erected within the District.
- b) The demolition or removal of any building or structure or any part thereof, within

the District. The Commission may refuse a certificate for the demolition or removal of any building or structure of architectural or historic interest, the removal of which in the opinion of the Commission, would be detrimental to the public interest.

c) The appropriateness of the erection or display of occupational, commercial or other signs and billboards within the District wherever a certificate of appropriateness for any such sign or billboard is required under section five.

In passing upon appropriateness, demolition or removal, the Commission shall determine whether the features, demolition or removal, sign or billboard involved will be appropriate for the purposes of this act, and, if it shall be determined to be inappropriate, shall determine whether, owing to conditions especially affecting the building, structure, sign or billboard involved, but not affecting the District generally, failure to approve an application will involve a substantial hardship to the applicant and whether such application may be approved without substantial detriment to the public welfare and without substantial derogation from the intent and purposes of this act. If the Commission determines that the features, demolition or removal, sign or billboard involved will be appropriate or, although inappropriate, owing to conditions as aforesaid, failure to approve an application will involve substantial hardship to the applicant and approval thereof may be made without substantial detriment or derogation as aforesaid, the Commission shall approve the application; but if the Commission does not so determine, the application shall be disapproved.

In passing upon appropriateness, the Commission shall consider, among other things, the historical value and significance of the building or structure, the general design, arrangement, texture, material and color of the features, sign or billboard involved and the relation of such factors to similar factors of buildings and structures in the immediate surroundings. The Commission shall consider settings, relative size of building and structures, but shall not consider detailed designs, interior arrangement and other building features not subject to public view. The Commission shall not make any recommendations or requirements except for the purpose of preventing changes in exterior architectural features obviously incongruous to the purposes set forth in this act.

The concurring vote of three members of the Commission shall be necessary to make a determination in favor of the applicant on any matter upon which the Commission is required to pass under this act. The Commission shall adopt rules and regulations for the conduct of its business not inconsistent with the provisions of the General Laws, Chapter 40C, and may, subject to appropriation, employ clerical and technical assistants or consultants, and may accept money gifts and expend same for such purposes.

Section 10. Appeals - Any person aggrieved by the determination of the Commission or by an approval of an application through failure of the Commission to make a determination within the time allowed under section eight, whether or not previously a party to the

proceeding may, within twenty days after the filing of a notice of such determination or approval with the Town Clerk, appeal to the superior court sitting in equity for the County of Barnstable. The court shall hear all pertinent evidence and determine the facts, and if, upon the facts so determined, such determination or approval is found to exceed the authority of the Commission, the court shall annul such determination or approval, and remand the case for further action by the Commission. The remedies provided by this action shall be exclusive, but the parties shall have all rights of appeal and exception as in other equity cases.

Costs shall not be allowed against the Commission unless it shall appear to the court that the Commission acted in bad faith or with malice in the matter from which the appeal was taken.

Costs shall not be allowed against the party appealing from such determination or approval of the Commission unless it shall appear to the court that said party acted in bad faith or with malice in making the appeal to the court.

Section 11. Enforcement - Any person who violates any provision of this By-law shall be fined not less than one hundred dollars (\$100.00) nor more than five hundred dollars (\$500.00). Each day of violation of this Act shall constitute a separate offense.

The Building Inspector and/or his agent or designee shall have the power and the duty to enforce the provisions of this By-law.

The Superior Court for the County of Barnstable shall have jurisdiction to enforce the provisions of this By-law and the determinations, rulings and regulations issued thereunder, and may restrain by injunction violations thereof and issue such other orders for relief of violations as may be required.

Section 12. Severability of Provisions - The provisions of this Act shall be deemed to be severable; and in case any part of this act shall be held unconstitutional by any court of competent jurisdiction, the decision of such court shall not affect or impair the validity of any other part.

A true copy, Attest:

Elinor E. Slade, Town Clerk

(Article 45 A.T.M. 5/9/74 - approved by Attorney General 5/9/74)

Amendment: - Section 11, adopted by A.T.M. Article 43 5/5/87
Approved by Attorney General 8/13/87

Amendment: - Section 4, adopted by A.T.M. Article 40 5/7/96
Approved by Attorney General 8/1/96



Appendix 5

Local Open Space Plans

CHAPTER 6

LONG SUMMARY

RECREATION AND OPEN SPACE PLAN

Revision of November 2001

Volume I

Prepared by:
Mark Robinson
and
the Staff of the Planning Division
Yarmouth Department of Community Development

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CONSULTANT'S CREDIT

For this particular chapter of the Comprehensive Plan, Chapter 6, Recreation and Open Space Plan, we have once again used Mark Robinson, the Executive Director of the Compact of Cape Cod Conservation Trusts, Inc. Mr. Robinson prepared the previous Recreation and Open Space Plan in 1996, which was endorsed by Town Meeting. This Plan replaced that one, in this case in its entirety, and that was also endorsed by Town Meeting, in April of 2002.

The objective has been to update the Plan every five years, and for that we have used a staff committee of three, Phil Whitten, Director of Parks, Pat Armstrong, Recreation Director, and Brad Hall, Conservation Administrator to provide review and guidance.

Preparing, editing, and updating the wording of the new plan so that it matched and reflected the changes that have taken place was a real challenge. But with the assistance of the four above-mentioned persons it has been accomplished. It has been our pleasure to work with them and they have been extremely helpful and knowledgeable.

We also want to thank Ms. Janice Strobl, Receptionist, and Brad Hall for their tabulation and analysis of the Recreation and Open Space Questionnaire. We could not have gathered that valuable information without them.

TABLE 1 - YARMOUTH COMPREHENSIVE PLAN SCHEDULE OF PLAN ENDORSEMENTS

Chapter No.	Title	Type of Article	Town Mtg. Type-Date	Article No.	Action
	Vision Statement	Policy <i>Amendment</i>	ATM - 27 Apr 94 ATM - 10 Apr 01	Art. 24 Art. 16	Endorsed Endorsed
1	Introduction of Comp Plan	Research			Not Presented
2	Outreach Program	Research			No Presented
3	Population Study and Forecasts, 1995-2015	Research			No Presented
4	Economic Development - Inventory	Research			No Presented
5	Intergovernmental Coordination and Resources of Regional Importance	Research			No Presented
6	Recreation and Open Space	Policy <i>Replacement</i>	ATM - 10 Apr. 97 STM - 27 Nov. 01	Art. 26 Art. 2	Endorsed Endorsed
7	Coastal Resources	Policy	ATM - 10 Apr. 97	Art. 27	Endorsed
8	Land Use/Growth Management	Policy	STM - 1 Dec. 98	Art. 1	Endorsed
9	Transportation Plan	Policy	ATM - 11 Apr 00	Art. 15	Endorsed
10	Economic Development	Policy	STM - 11 Jan 00	Art. 7	Endorsed
11	Wetlands	Policy	ATM - 14 Apr. 98	Art. 14	Endorsed
12	Water Resources Plan	Policy <i>Replacement</i>	STM - 29 Jul 97 STM - 27 Nov. 01	Art. 2 Art. 2	Endorsed Endorsed
13	Wildlife and Plant Habitat	Policy	ATM - 14 Apr. 99	Art. 14	Endorsed
14	Affordable Housing	Policy	STM 10 Feb. 98	Art. 2	Endorsed
15	Community character Chapter -Scenic Vistas -Historic Preservation Portion	Policy Policy	ATM 10 Apr. 01 ATM 10 Apr. 01	Art. 15 Art. 15	Endorsed Endorsed
16	Infrastructure Chapter - Solid and Liquid Waste Portion	Policy	STM - 27 Nov. 01	Art. 3	Endorsed
17	Intergovernmental Coordination and Resources of Regional Importance	Policy <i>Supersedes Chapter 5</i>	ATM - 27 Nov. 01	Art. 16	Endorsed
18	Implementation, Financial Information, and Capital Programming	Policy	STM - 27 Nov. 01	Art. 3	Endorsed
19	Community Facilities and Services - energy Portion	Policy	STM - 27 Nov. 01	Art. 4	Endorsed

INTRODUCTION

**ORGANIZATION
PREPARING THE PLAN
PRESENTATION OF ELEMENTS
USE OF "LONG SUMMARY" APPROACH
UPDATES OF SUBJECTS**

INTRODUCTION TO THE COMPREHENSIVE PLAN

ORGANIZATION OF THE COMPREHENSIVE PLAN

The Yarmouth Comprehensive Plan is organized so that it will be done by individual chapters about each pertinent subject. There are 18 of these in our basic work program, and 16 have been completed, with 11 endorsed by Town Meeting and the 5 others used as reference documents not requiring action. We are the only Cape town using this incremental approach. It has been slower, but surer for us! This particular chapter, numbered 6 in the work program, contains the Open Space and Recreation Plan. This document is its "long summary" form. It is one of the basic skeleton chapters of the plan, along with Land Use/Growth Management, Economic Development, and the Transportation Plan.

WHO IS PREPARING THE PLAN?

Primary guidance for the comprehensive planning program is being given by the "Local Planning Committee", which is made up of the Planning Board, with the assistance of the Growth Policy Advisory Council. Much of the technical work is being done by the Planning staff, with advice, recommendations and analysis from the consultant, Mark Robinson, Director, Compact of Cape Cod Conservation Trusts of Barnstable, MA. He has prepared much of the professional material for this element and assisted the staff and committees. For this subject we have also used staff and a subcommittee representing Conservation, Recreation and Parks, to help gain consensus.

PRESENTATION OF THE PLAN ELEMENTS

You may have noticed the terms "executive summary" and "long summary" in the title pages and in the text. One of the problems in presenting any town's comprehensive plan is that it is written usually for three different groupings of people. Most want only the basics and not a lot of detail, thus we prepare "executive summaries". A second level of interest includes those looking for more basic technical and planning information, such as in this document, the "long summary". Finally a few want to see our detailed consultant materials. Thus we have prepared all three levels of reports for the Plan Elements.

PRESENTING THE COMPREHENSIVE PLAN

In preparing such a far-reaching and complicated plan as this, we realize there must be an extensive and a continuous outreach program. In addition to the required hearings, we are continuing to use television and radio whenever possible, as well as specially prepared handouts for meetings and "executive summaries" for Town Meeting action. Each of the Comprehensive Plan's Chapters is also a "stand alone" document in itself, so that it can be used separately, or as part of the overall program.

USE OF THE "LONG SUMMARY" APPROACH

The middle level of detail described previously, or the so-called "long summary" is the support document we have used the most. It is sufficient in detail to satisfy most interested persons, and they are also incorporated by reference into the Town Meeting votes on each chapter. This document is a "long summary" concerning the subject of Open Space and Recreation.

The "long summaries" are bound in looseleaf notebook form so that they may be added to, or amended, or even deleted, fairly easily. It is intended to be used for interested and concerned citizens and committees, and updated on a regular basis. As far as we know we are the only Cape town using this approach.

REGULAR UPDATES OF VARIOUS SUBJECTS IN COMPREHENSIVE PLAN

- * The first Open Space and Recreation Chapter was prepared in 1996 by Mark Robinson, Consultant for the same staff sub-committee as is now being used.
- * In April of 1997 his report was placed into a format that matched the Yarmouth Comprehensive Plan program with executive and long summaries. It was adopted after extensive public outreach by a Town Meeting action with only a few negative votes.
- * Now 5 years later it is time to update the previous document to take cognizance of the many changes that have taken place, and in particular the improvements at the Old Town House Road site.
- * It is expected that there will continue to be regular 5 year updates on this Plan subject, not only because it is needed because of on-going changes, but because it is very desirable to meet the requirements of the State' Comprehensive Outdoor Recreation Program.

SETTING THE SCENE

OPEN SPACE AND RECREATION SETTING THE SCENE

Open character is one of Cape Cod's strongest assets. Cranberry bogs and woodlands contribute directly to key industries in the area and Town, attracting tourists and providing areas for cranberry growing, while water bodies provide areas for fishing and swimming. However the Town of Yarmouth is nearly fully built-out and at risk of losing these attributes that draw tourists and retirees alike to the community. Open space continues to be lost to development, even though 28% of the Town's area is now in public ownership. We need to continue to slowly add to our open land inventory while trying to fulfill the needs of a vibrant and expanding municipality of some 25,000 permanent residents.

Cape Cod residents have indicated that the seasonal character of the Cape was an important factor in their deciding to live here. That has certainly been true in Yarmouth. Our expenditures for land bank purposes indicate how seriously this problem is viewed by local residents. Developments of Regional Impact (DRI's) often require developers of land to provide to the Town's "open space".

Important open space related resources that presently have little or no protection include archaeological sites, significant land forms, scenic roads and views. Hence our interest in other chapters of the Comprehensive Plan in identifying and protecting them. Scenic roads and views are critical to the tourist industry. Once visitors perceive that the Cape's natural character has vanished they will also, as will the tourists and their expenditures.

Cape Cod and Yarmouth possess a rich heritage of open space resources. The federal government has some large holdings on the Cape, but few in Yarmouth. The Commonwealth also owns significant open space areas, but elsewhere on the Cape. In large part therefore, we in Yarmouth are on our own to protect this precious resource.

In 1993 Barnstable County and the Cape Cod Commission began an initiative called "Cape Cod Pathways", designed to create a Cape-wide network of walking trails linking all 15 towns. The effort will provide a year-round recreational opportunity for both residents and visitors. The project has received widespread support and endorsements from all 15 towns including Yarmouth.

In the 1980's many Cape towns embarked on an ambitious land acquisition program for conservation, recreation, and watershed protection. Yarmouth was one of these, with the last large land taking authorized in 1987. Although commendable, this led to over 65 land taking suits, more than tripling the cost of the various parcels. The last of these suits has only recently been settled. The Selectmen now authorize only "friendly" takings, beyond the Land Bank takings.

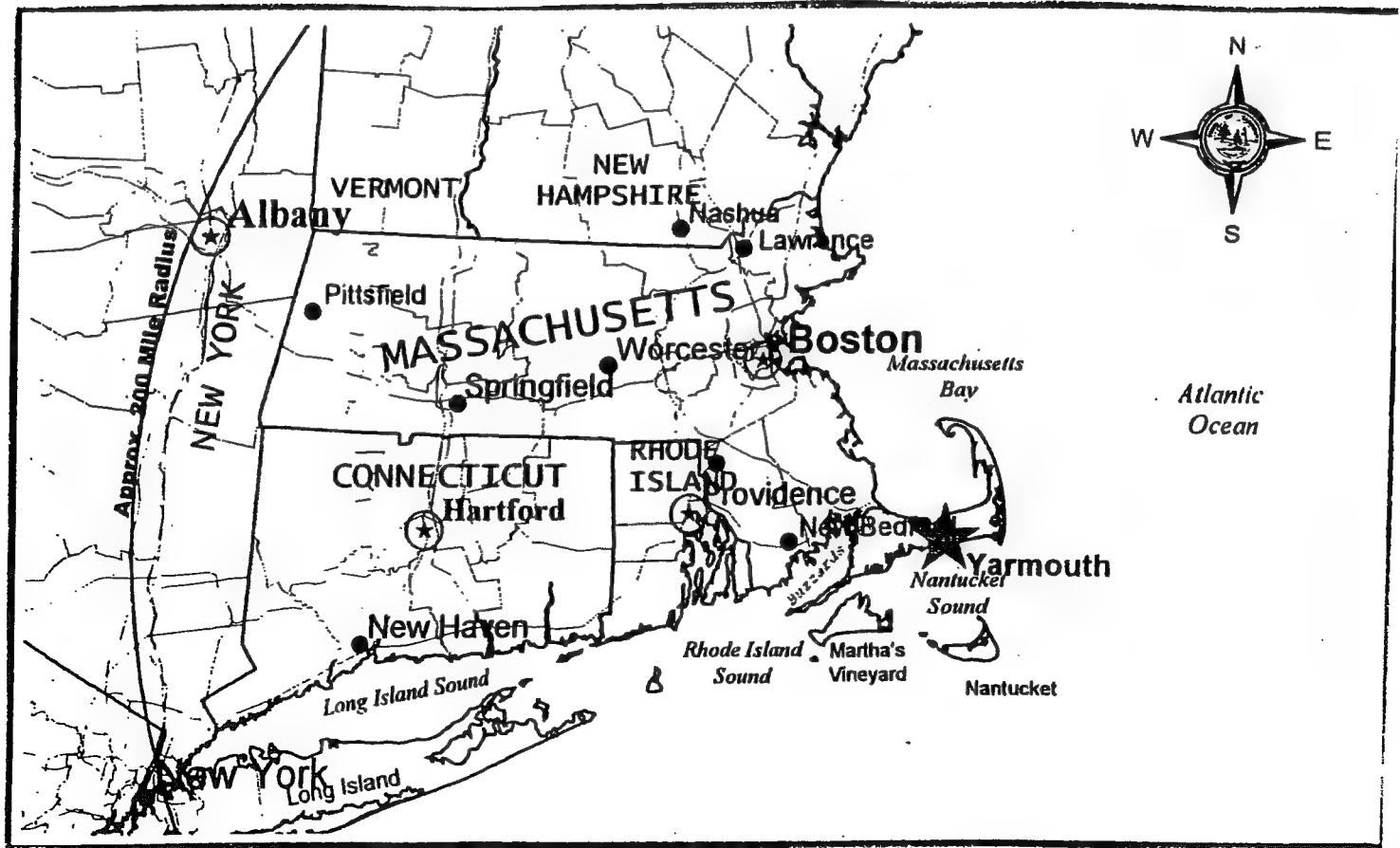
Through the development of local open space plans, Yarmouth like many Cape communities, has sought to protect significant natural and fragile areas, such as outstanding water resources, shore lands, and wetlands. The percentages of reserved open space varies widely on Cape, from 12 to 71%

in various towns. Yarmouth's 28%, about 4,500 acres, is proportion the largest in the larger towns.

Many Cape communities have attempted to protect open space by requiring that new development set aside a certain percentage of open space within the development. Yarmouth did that during the 1965-85 growth period, but the State's Supreme Court ruled this a "taking" and the parcels, though often desirable, were usually returned to the developer. Many of these were building lot sized parcels, and with relaxed "grandfathering" in Yarmouth we are experiencing infill at the rate of 60-90 units a year, only compounding our visual impact upon people that there is a dense sea of suburban subdivisions in Yarmouth.

Opportunities for active and passive recreation programs in the remaining natural environment are here in Yarmouth. Historically, the most common outdoor activities have included boating, fishing, swimming, walking and bicycling. Certainly all of these are generally compatible with the natural environment and the protection of wildlife habitat. But there is an even further scope to the problem, and that is to provide for the ever-increasing demand for active recreation areas. The conversion of the Old Town House Road site from landfill to a golf course - 9 holes, and active recreation uses, is an example of an award winning design, but there appears to be an ever-increasing active recreation use of the fields for not only our younger and youthful population, but our rapidly increasing active elder population. That is our challenge!

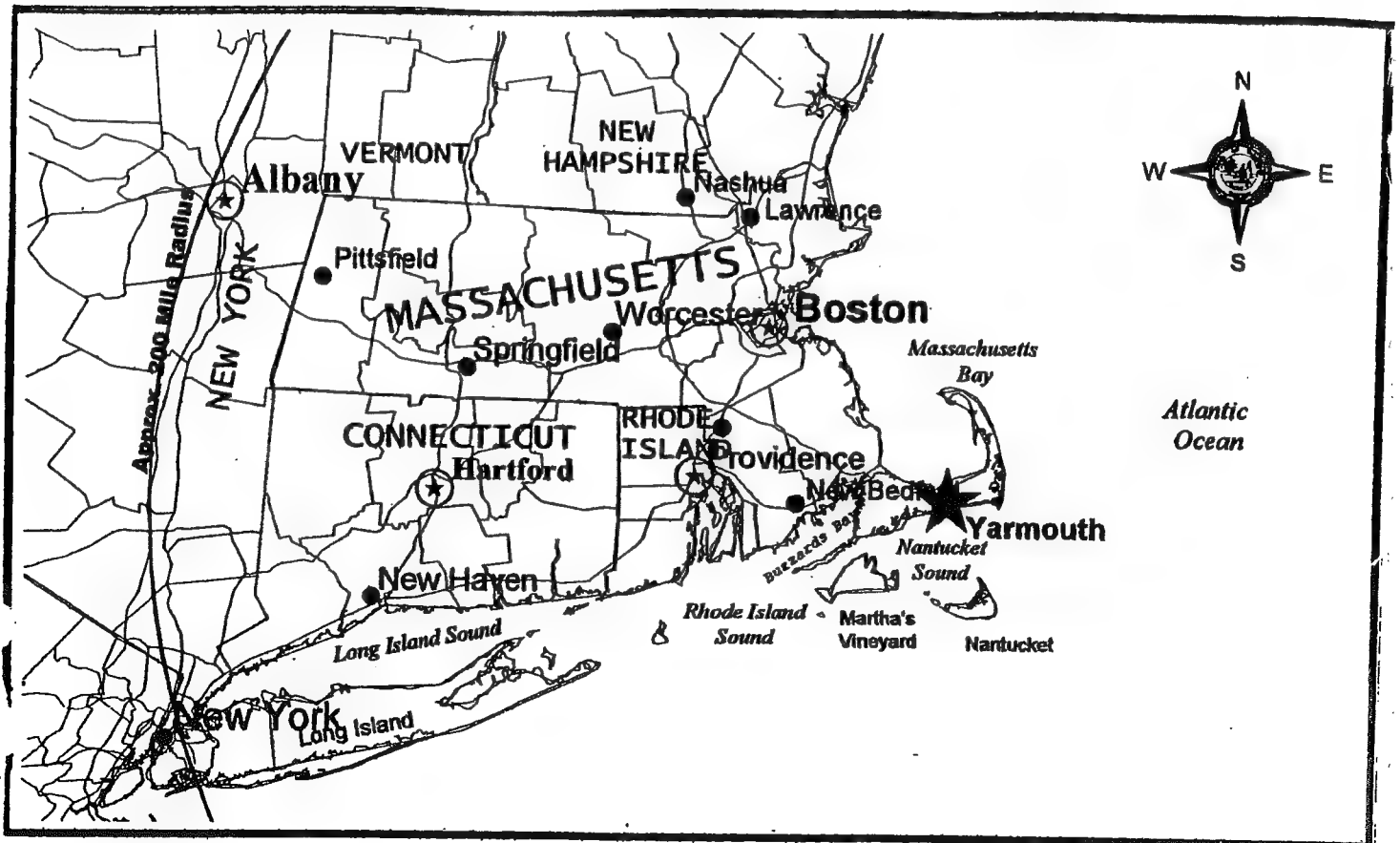
REGIONAL LOCATION MAP



6-1 Map from Here to New York City/ Albany and Portland, Maine

The importance of the Cape Cod location cannot be over-emphasized. Yarmouth lies on the Cape Cod neck some 22 miles out into the Atlantic Ocean on a spit of sand pushed up by the last glaciation purported to be 25,000 years ago. It is both the best and worst of locations. On the one hand it is remote for some things and yet not very accessible for others. Improved telecommunication has made it just that much more accessible.

SOUTHEASTERN MASSACHUSETTS MAP



6-2 Map of Yarmouth - in Southeastern New England location

While the Cape was indeed an off-beat site for years, first the construction of the bridges over the canal in the early 1930's, and then the construction of the interstate highway system in the mid-1950's, made it highly accessible for tourists and retirees.

The Cape has boomed as a result. But it is a boom that has been achieved at a price - traffic jams, pollution, over-crowding, noise, etc. However this is a location that attracts high-tech trained business persons, especially in telecommunications, and related businesses. That kind of business or industry, although dependent on rapid communications, will cause further growth and stress.

One of the main purposes of the Comprehensive Plan is to try to help deal with the dislocations related to change.

**INVENTORY OF CONSERVATION
AND
RECREATION LANDS**

INVENTORY OF CONSERVATION AND RECREATION LANDS

A. Introduction

In 1991 the Cape Cod Commission proposed a regional open space greenbelt system throughout Barnstable County, whose purpose is to "link existing protected open space and sensitive resources including wildlife habitat, wetland, and zones of contribution to public wells to establish a regional network of connected open space." Towns were asked to refine this greenbelt as it falls within their borders, as they develop local comprehensive plans. In Yarmouth, the Commission proposed including the Bay marshes and conservation lands in the greenbelt, as well as wetland corridors along Bass River and Parker's River and much of the west side of town, connecting up to the Hyannis Ponds State Wildlife Refuge.

B. Public Lands and Facilities

With 4,285 acres under its control, the Town of Yarmouth is the largest landowner in Yarmouth (see Table 5.1 & 5.1a)* A large percentage of this land is devoted to conservation (1,700 acres), though much of this acreage is unbuildable wetland. Another major portion (961 acres) consists of large blocks of woodland held for public water supply wells and wellfield protection. As a community, then, Yarmouth has made a strong commitment to the setting aside of lands for public use and natural resources protection.

A combination of factors - historical, geographical and political - has resulted, however, in a less than perfect distribution of these lands. Wellfields, for example, were purchased where wells would yield (but also where land was less expensive) in the West Yarmouth hinterlands. Conservation areas were assembled where land was unbuildable, primarily due to wetland soils (Yarmouthport) or lack of access for development (along the moraine). This opportunistic pattern, repeated through many Cape Cod towns, reveals the ad hoc decision making by local officials in the past (which has left Yarmouthport without a school or recreational fields), which an open space and recreation action plan and professional guidance by the town's Planning Division can perhaps remedy for the future.

Still, Yarmouth has done a better job than most in connecting the open space holdings in its interior. The studies that led to the 1986 Yarmouth Open Space and Recreation Plan, for instance, laid the framework for the ambitious municipal land purchases of the 1980's. Between the years 1984-87, the Town acquired through gift or purchase, 1,094.6 acres for assorted uses - about one-quarter of all its present holdings - many of them linked to previous acquisitions.¹⁰¹

The most popular town conservation areas, in terms of frequent use, are Callery-Darling, along the Northside marshes, and the woodlands south of Dennis Pond. The Natural Resources Department, not the Conservation Commission, is responsible for (and budgeted for) day to day management of all town conservation areas. The Callery parcel (125 acres) was purchased in 1975 with a gift of \$54,327.87 from the Mary Thacher Trust fund. Most of the Dennis Pond lands were also purchased or donated in the 1970's.¹⁰²

* The table numbering system that is being used is from the Consultant's report on the Recreation and Open Space Plan.

¹⁰¹ Marion Vuilleumer, The Town of Yarmouth, Massachusetts: A History. 1639-1989.

¹⁰² Marion Vuilleumer, The Town of Yarmouth, Massachusetts: A History p. 277.

TABLE 5-1

TOWN OWNED LANDS BY USE, 1996

MANAGER/USE	W. YARMOUTH	YARMOUTHPORT	S. YARMOUTH	TOTALS	PERCENTAGE
CONSERVATION	430.85	1139.22	79.36	1649.43	11%
CEMETERY	35.94	19.42	6.82	62.18	0%
RECREATION	228.79	19.75	64.34	312.88	2%
SCHOOL	76.75	0	132.82	209.57	1%
WELLFIELD	662.47	161.6	137.34	961.41	6%
HOUSING	0	16.19	25.79	41.98	0%
GOLF	310	0	121.08	431.08	3%
WASTE MGT.	202.85	0	34.5	237.35	2%
OTHER	123.14	73.55	39.06	235.75	2%
TOWN-OWNED	1557.94	1429.73	485.53	4141.63	27%
NON-TOWN OWNED	Acres	Acres	Acres	11301.37	73%
TOWN LAND MASS (Except Water)	Acres	Acres	Acres	15433.00	100%

Plus 24.5 acres Stage Island, Bass river in Dennis

South Yarmouth Conservation Commission and Assessor's Office, 1996; town land mass from Yarmouth Planning Dept.
(See table 6.1a for 2001 update.

TABLE 5.1.a

OPEN SPACE LAND ACQUISITIONS BY TOWN OF YARMOUTH (1996-2001)

TABLE 5.1.a

OPEN SPACE LAND ACQUISITIONS BY TOWN OF YARMOUTH (1996-2001)

YEAR	GRANTOR	Upland	Wetland	TOTAL	PRIMARY	HABITATS	DEED REF.	DEED Bk/Pg	PLAN Book/Page/Lot	COMMENTS	STREET ADDRESS	VILLAGE	MAP	PARCEL	LAND BANK	PURCHASE PRICE
1997	multiple	8.08	0.00	8.08			11120/121		--	drainage & watershed prot.	Capl. Nickerson Road, S.Y.	SY	78	20	No	\$150,000
1998	James RUHAN	0.35	0.00	0.35	Hawes Run; stream		11405/129		264/94; lot 16	drainage; DPW	545 Buck Island Road	WY	45	79	No	\$6,100
1998	MMP Realty Trust (Desmond)	0.51	0.00	0.51	pine woods		11603/81		170/103	wetland prot.; Water Dept.	99 Union Street	YP	115	57.1	No	\$38,000
1998	R. KAUFMAN & S. FEDELE	0.00	37.65	37.65	cedar swamp		11921/253		459/28	conservation; ConCom	off Camp Street	WY	44	4	No	\$0
1998	Yarmouth CAMPGROUND ASS.	0.63	0.00	0.63	pine woods; 30' wide		LCD26162		LCP350308; LOT 4	drainage, multi-use path	west side Willow Street	WY	83	--	No	\$900
1999	R. MALOOF & J. DAWAHARE	0.37	0.00	0.37	house lot		12754/151		238/111; lot 2	conservation; ConCom	8 Florence Lane	WY	23	311	No	\$0
2000	Guido PERERA et al	1.00	0.00	1.00	salt marsh island		13460/34		--; Bassett's Island	conservation; ConCom	off Thatcher Shore Road	YP	121	Temp 110	No	\$0
2000	Peter Roberts Trust (Alvezos)	5.00	2.70	7.70	cedar swamp		13482/174		Pat. Plan 42188A	conservation; ConCom	Buck Island Road	WY	45	80	No	\$0
	Total Non-Land Bank Acres	15.94	40.35	56.29												\$195,000
1999	C.C. SEASIDE (Rascals)	2.59	0.00	2.59	Mill Creek; stream		12301/348		12/99.	open space; Selectmen	Route 28	WY	37	61	Yes	\$140,000
2000	Roland LARAMIE	0.25	0.86	1.11	dune; salt marsh		12816/139		25/49; Lot 82, 84, 107	open space; Selectmen	Connecticut Avenue	WY	16	30, 34	Yes	\$8,000
2000	JONES, SWIFT, DREW & ALVES	4.62	0.00	4.62	pine/oak woods		13032/151		--; abuts RL 6	open space; Selectmen	Willow Street	WY	83	6	Yes	\$15,000
2000	J. SHIELDS RT. (Shields, Can, Song)	5.47	0.00	5.47	pine woods		12812/100		--; near RR bed	open space; Selectmen	Old Town House Road East	SY	100	10	Yes	\$47,000
2000	Rex WHITE	3.52	0.00	3.52	pine woods		12974/180		240/5; lot 3	open space; Selectmen	Old Town House Road East	SY	100	11	Yes	\$120,000
2000	Glenn SALVADOR	1.00	2.00	3.00	salt marsh; Halls Dock		12974/190		--;	open space; Selectmen	Hockanom Road	YP	150	34	Yes	\$20,000
2000	JORDAN-PERCE CORP.	2.39	1.60	3.99	salt marsh; island		12832/77		229/31; lots 17 & 20	open space; Selectmen	67 & 91 Pleasant Cove Circle	YP	149	46, 49	Yes	\$120,000
2000	Beas River Realty Trust (SHAMSI)	0.53	0.00	0.53	grassed lot; parking		13085/236		--;	open space; Selectmen	311 Old Main Street	SY	61	84	Yes	\$150,000
2000	COOG, CHURCH, GORHAM et al	2.93	0.00	2.93	pine/oak woods		13054/280		--;	open space; Selectmen	off West Great Western Rd.	SY	108	33	Yes	\$8,900
2000	Michael P. PAZAKIS Trust	2.16	0.00	2.16	pine/oak woods		13054/283		--;	open space; Selectmen	off West Great Western Rd.	SY	108	37	Yes	\$10,000
2000	Tara L. NOLAN	0.25	0.17	0.42	coastal bank; salt marsh		13117/105		219/117; lot 4B	open space & rec.; Selectmen	25 Prince Rd. @ Mill Creek	WY	29	92	Yes	\$17,700
2000	Lawrence T. PERERA	17.65	0.00	17.65	pine/oak woods		13447/186		562/1; lot B	open space; Selectmen	White Rock Road & Pine St.	YP	122	84 (part)	Yes	\$375,000
2000	THACHER ROAD RT. (Perera)	2.11	2.14	4.25	beech/maple woods		13442/194		215/115; lot 1	open space; Selectmen	169 Thacher Shore Road	YP	122	69	Yes	\$245,000
2001	Maximas HATZILIADES	3.05	4.00	7.05	Mill Pond shore		13638/325		556/32; lots 2 & 3	open space; Selectmen	262 & 270 Weir Road	YP	117	1.2 & 1.3	Yes	\$388,000
2001	John Gregory ANDERSON	0.61	0.00	0.61	"cellar house"		(Jan. '02)		Peckat Landing @ Bass River	open space; Selectmen	1377 Bridge Street	SY	78	61	Yes (part)*	\$150,000
2001	MIDDLETOWN CRANBERRY Co.	13.00	13.46	26.46	cran. bog; pine woods		13723/46		Beaton Bog	open space; agricult.; Select.	221 Union Street	YP	106	84, 1 & 122	Yes	\$550,000
2001	Alex, Thomas & Robt. TROIANO	0.00	1.77	1.77	salt marsh		14625/62		112/5; lots 58, 59, 60	open space; Selectmen	86, 90, 96 Gleason Ave.	WY	29	65, 66, 67	Yes	\$19,500
2001	John CAMBIA	0.29	0.00	0.29	coastal bank		14625/59		229/31; lot 10	open space; Selectmen	8 Windswept Way	YP	149	10	Yes	\$5,000
	Total Land Bank Acres	62.42	26.00	88.42												\$2,389,100
	1996-2001 GRAND TOTALS	78.36	66.35	144.71												\$425,000
																\$3,009,100

12/01

Source: The Compact of Cape Cod Conservation Trusts, Inc.

12/01

Source: The Compact of Cape Cod Conservation Trusts, Inc.

The Commonwealth of Massachusetts is represented in Yarmouth primarily by its Route 6 right of way, running as a double-barreled, limited access highway from the Barnstable line to Dennis. A highway rest area, including pine-shaded picnic tables overlooking Follins Pond and Dinah's Pond, was located at Taylor's Point on Route 6 westbound, but this roadside attraction was closed in the past five years. (The Massachusetts Highway Department also maintains garaging and salt sheds on seven acres of Higgins Crowell Rd., WY.) The right of way varies in width, but averages 300 feet, though the actual road bed rarely exceeds 100 feet wide. The wide shoulders, therefore, provide a natural greenbelt to the highway.

In 1995, to aid protection of waterfowl habitat, the Yarmouth Conservation Trust facilitated purchase of 56 acres of salt marsh by the Massachusetts Division of Fisheries and Wildlife (for \$90,720) in Chase Garden Creek as a state conservation area. There is no state management presence at this facility. Hunting and fishing are allowed; no parking area is provided. The state-owned marsh filled a key gap between town-owned marsh holdings. The Town Land Bank proposes purchasing another inholding along the marsh edge in 2001.

The Massachusetts Bay Transit Authority (MBTA) owned the 5.5 miles of railroad bed that run east and west through town and south to Hyannis. In 1997 then Governor Cellucci announced his intent to have the state donate the two-mile long 12-acre rail bed segment east of the transfer station to the Town for recreational purposes, including extension of the popular bike path (Cape Cod Rail Trail) west from Route 134 in Dennis. Though this transfer has since been made, the design problem of how to handle a bike trail crossing over Bass River remains. The Town of Dennis is reportedly responsible for designing and building the actual river crossing over the old trestle, so some inter-town coordination will be needed.

The town owns other properties for general municipal purposes which are used de facto for conservation and recreation. About 80 acres of these "undesignated use" parcels, under the control of the Selectmen, could be formally transferred to the Conservation Commission for increased statutory protection and augmentation of existing conservation areas. (See Appendix B of 1996 Plan) Also, since the advent of the Land Bank, most parcels purchased under its aegis are acquired for "open space" and are not assigned to the Conservation Commission or Recreation Commission; it is assumed that the Selectmen retain management authority over Land Bank lands. The obvious conservation lands from that list, such as those near wetlands or other town conservation areas, could be transferred to the Conservation Commission. (See Appendix B of the 1996 Plan for a complete list of town-owned open space by village.)

C. OPEN SPACE LAND ACQUISITIONS BY TOWN OF YARMOUTH (1996-2001)

In November 1999, Yarmouth voters in the general election joined all other Cape Cod towns in approving a binding referendum accepting the provisions of the Cape Cod Open Space Land Acquisition Program, the so-called Land Bank bill.¹⁰³ Under the Act, town voters agreed to adopt a three percent surcharge on property tax bills, from 1999 through 2020. Revenues generated,

¹⁰³ Chapter 293 of the Acts of 1998.

approximately \$800,000 per year in Yarmouth , are dedicated solely for the purpose of open space. For the years 1999-2002, the Commonwealth is providing an automatic 50% matching grant relative to the town's land bank receipts.¹⁰⁴ The Selectmen appointed a Land Bank Committee in 1999, which identifies important conservation and recreation land parcels, negotiates purchase agreements, and presents the agreements to Town Meeting for approval.

Since Spring Town Meeting in 1999, the Land Bank has proposed the purchase of 18 parcels totaling 88 acres for negotiated prices totaling \$2,389,100. (See Table 5.1.a) Town Meeting has approved all of these purchases, typically with wide support. The average price per acre of \$27,000 in Yarmouth compares favorably with the Cape Cod average of \$26,000. The Land Bank Committee reports that many of the larger vacant parcels still remaining in town are not for sale or otherwise available, and hostile takings have not been contemplated. Still, the types of properties which have been purchased so far is impressive: the Town's most scenic cranberry bog (Beaton Bog on Union Street); 18 acres of woods abutting the Thacher Conservation Area on Pine Street; marsh edge properties in West Yarmouth and Yarmouthport; Chase Brook Park and Packet Landing along Route 28; wellfield protection land in South Yarmouth; and 700 feet of pond shore at the head of Bass River's Mill Pond. (See Table 5.1.a)

All of the parcels purchased using Land Bank funds have been for general open space purposes as defined by the Land Bank Act and entrusted to the care and custody of the Selectmen. These purposes include conservation or recreation. By not assigning a specific use in the Town Meeting vote and in the deeds, it is possible that these land bank parcels could be shifted to one or more uses within the definition. Thus, there is no guarantee that natural areas being acquired will remain natural; they could be converted into manicured playing fields. In the past, Town Meeting devoted natural areas which were acquired to the Conservation Commission, wellfield protection lands to the Water Department, etc.

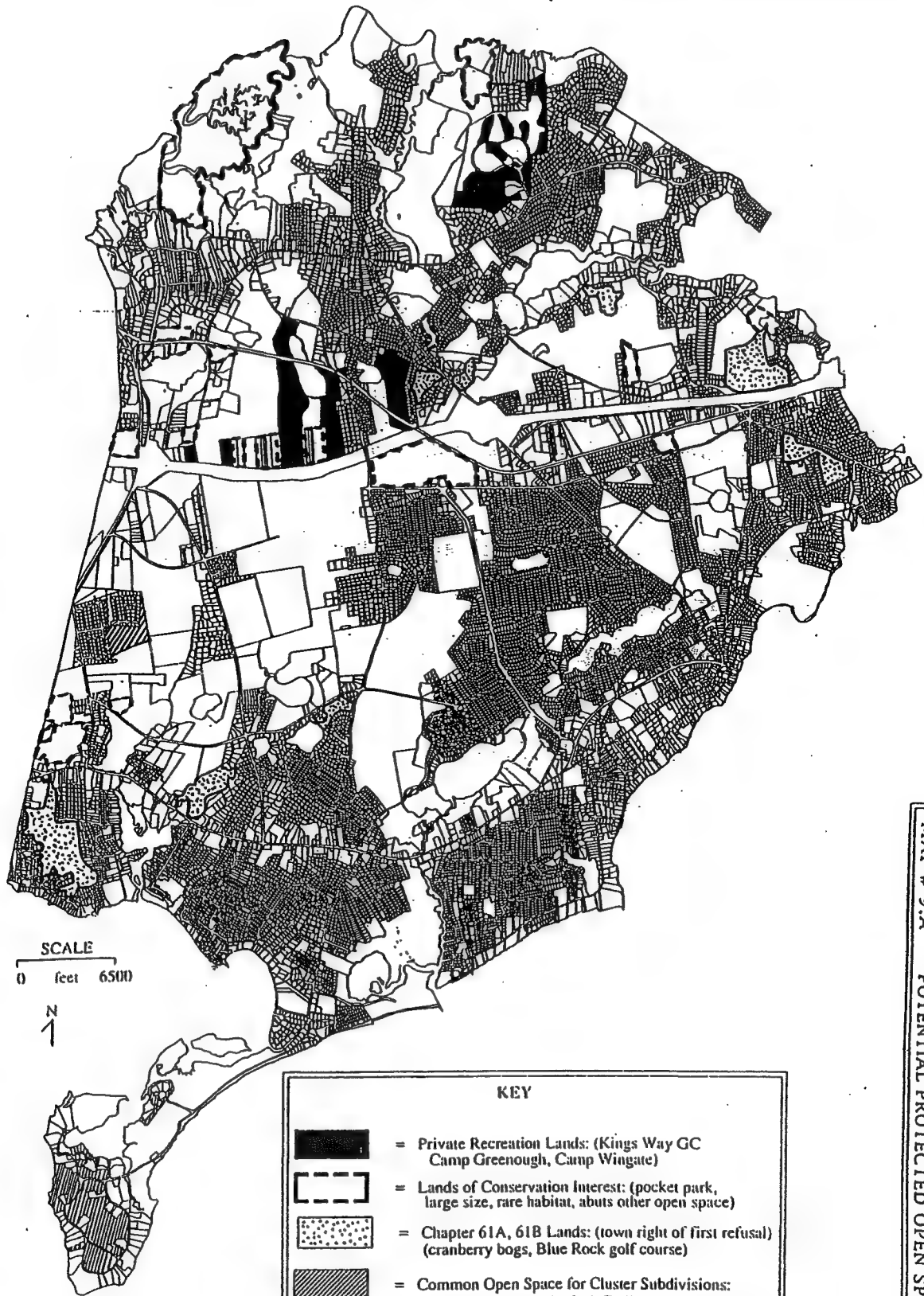
D.PRIVATE OPEN SPACE LANDS AND FACILITIES (See Maps 5.1,5.2, and 5.3&9A)

Augmenting the town-owned open space lands are approximately 1500 acres of land with varying degrees of legal protection against development. (See Table 5.2) The Cape Cod Council, Boy Scouts of America, Inc. operates 271-acre Camp Greenough as a seasonal camping facility for scouts. Established with an original gift of land under the will of Henry C. Thacher in 1944 at the south end of Greenough Pond, other lands were donated or sold to the Council over the next 30 years. About three quarters of the camp's landholding is protected through reverter clauses in the deeds, which stipulate that if the land is ever to be used for purposes not consistent with the Council's "chartered purpose," then title will be transferred to the Yarmouth Conservation Commission.¹⁰⁵ Approximately 145 acres were acquired without these reverters; those lands could be disposed of by the Council.

¹⁰⁴ Approximately \$1.1 million total was available through town and state receipts in FY2000. (Yarmouth Annual Report, 1999.) The Land Bank Committee's report was missing from the 2000 Annual Report.

¹⁰⁵ Barnstable Registry of Deeds: Book 1228, pages 537,570,573; Book 1244, page 597; Book 1301, page 195. (It is unclear if these reverter clauses are effective in perpetuity or become expired after 30 years unless renewed, a time period now elapsed)

**YARMOUTH OPEN SPACE and RECREATION PLAN, 1996
MAP # 9.A POTENTIAL PROTECTED OPEN SPACE**



**YARMOUTH OPEN SPACE and RECREATION PLAN, 1996
MAP # 9.A POTENTIAL PROTECTED OPEN SPACE**

TOWN OF DENNIS

OPEN SPACE AND RECREATION

PLAN UPDATE – 2003

FINAL

MAY 15, 2004

Prepared by:

Dennis Planning Dept. in cooperation with the Dennis Natural Resources Office, Conservation Commission, Beach and Recreation Department and Land Acquisition Committee

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SECTION 1 PLAN SUMMARY

The Town of Dennis has been very aggressive over the past five years in the implementation of the open space and recreation recommendations found in the 1998 Open Space and Recreation Plan Update. This plan serves as an update to that plan, highlighting the accomplishments, noting areas where additional work may be necessary, and identifying new goals as needed for the town to pursue in the future. The plan builds upon the 1998 Open Space and Recreation Plan Update and its earlier versions completed in 1984 and 1986. The plan is also intended to meet the state's 1990 Open Space and Recreation Plan Requirements. The update builds on the earlier plan, incorporating goals of protecting natural resources, conserving open space and providing a varied recreation program. The plan seeks to address these goals simultaneously where possible by encouraging preservation of open space, while allowing opportunities for its enjoyment through modest improvements which provide access for passive recreation.

This update presents continued participation in the Cape Cod Pathways trail network, and incorporates goals for accessibility for both recreation and open space facilities. There continues to be an emphasis on open space preservation by means other than direct acquisition, for instance, through conservation restrictions, donation, cluster zoning, etc., in response to current economic conditions. However, it recognizes the importance of acquisition when necessary to preserve critical resources.

Public participation is an important part of the plan and all of the town's open space provide opportunities for recreation activities. The plan represents the combined efforts of several town committees and departments, including the Recreation Commission, Beach Commission, Conservation Commission, Land Bank Committee, Board of Selectmen, Town Administrator's Office, Town Planner's Office, Natural Resources Department, Department of Public Works and the Beach and Recreation Department.

The current Open Space and Recreation Plan serves as an element of the recently completed Dennis Local Comprehensive Plan (LCP). The LCP, has gained preliminary approval of the Cape Cod Commission and was endorsed by Dennis Town Meeting on September 23,

2002. The Local Comprehensive Plan serves as the town's response to the Cape Cod Regional Policy Plan to guide planning and growth decisions overall for the town.

Approval of this update by the state Division of Conservation Services will enable the Town to be eligible for land acquisition and recreation facility reimbursement funding through programs, such as Self Help, Urban Self Help and the Federal Land & Water Conservation Fund. Between 1998 and 2003, the Town of Dennis received \$247,000 for the Charles Johnson Property (Howe's Pasture), 7.87 acres off of Beach Street from these state and federal reimbursement programs.

SECTION 2 INTRODUCTION

A. Statement of Purpose

Dennis's Open Space and Recreation Plan Update is intended to continue to provide a framework for decision-making by its residents. The purpose of the update is to serve as a guide to responsible action to conserve Dennis's natural resources, preserve its open space and provide ample opportunities for recreation for its citizens.

B. Previous Efforts

This plan represents the current culmination of over 30 years of open space and recreation planning in the Town of Dennis. Among the first principal efforts was the Town of Dennis Planning Proposals and Policies Report prepared by the Massachusetts Department of Community Affairs in 1974. That report, conducted for the Town of Dennis Comprehensive Planning Committee, included sections devoted to "Natural Resources and Physical Features" and Open Space and Recreation." In 1975, the Barnstable County Conservation District prepared a study entitled, Natural Resources Planning Program of the Town of Dennis, which evaluated specific natural areas for protection and passive recreation. An inventory report entitled Natural and Visual Resources, Dennis, Mass., was printed in 1976 by the University of Massachusetts and included principles and goals for conservation and recreation. In 1979, a "Recreation Master Plan" was adopted by the town, outlining the need for public recreational facilities.

In 1984, a more comprehensive document, Conservation and Recreation Plan, was prepared by Interchange (consulting firm) and provided a framework to advance the town's ambitious land acquisition program at 1985 Town Meeting. This plan was the town's first to receive (provisional) state approval by the Division of Conservation Services. In 1985 the Town of Dennis Planning Department prepared a "Land Availability Study," which was used to prepare the 1986 Town of Dennis Open Space and Recreation Plan, which was approved by the state for use through 1991.

In 1994 the town began its preparation of a Local Comprehensive Plan (LCP) in compliance with the Cape Cod Regional Policy Plan (1991, amended 1996). This comprehensive plan was ultimately endorsed by Dennis Town Meeting on September 23, 2002 and includes a full build-out and capacity analysis and guide development for the next 20 years. The 1998 Open Space and Recreation Plan was be incorporated by reference into the LCP and the recommendations of the 1998 OSRP were incorporated into the 2001 LCP..



Appendix 6

News Paper Articles

Plan to extend bike path through Dennis

Only concern cited by residents is the noise level

By Megan Trench
GLOBE STAFF

and Erin Conroy
GLOBE CORRESPONDENT

For decades, the Cape Cod Rail Trail has drawn thousands of bicyclists hoping to escape the bustle and concrete of city life for the Cape's tranquillity and verdant scenery. And now town officials and bicycle enthusiasts hope to extend the popular path 6 miles along the beaches and woods of Dennis and Yarmouth to the Barnstable border.

"The more trails, the more exposure and the better it is for tourists and people that live here to get east of Route 134," said Barry Worth of Harwich, a member of the town's bikeways committee.

Two town meetings about the proposed project — one Sept. 20 at a police station in Yarmouth and another Sept. 21 at a senior center in Dennis — drew mostly support and a little concern from dozens of residents worried about having a bike path run near their backyards.

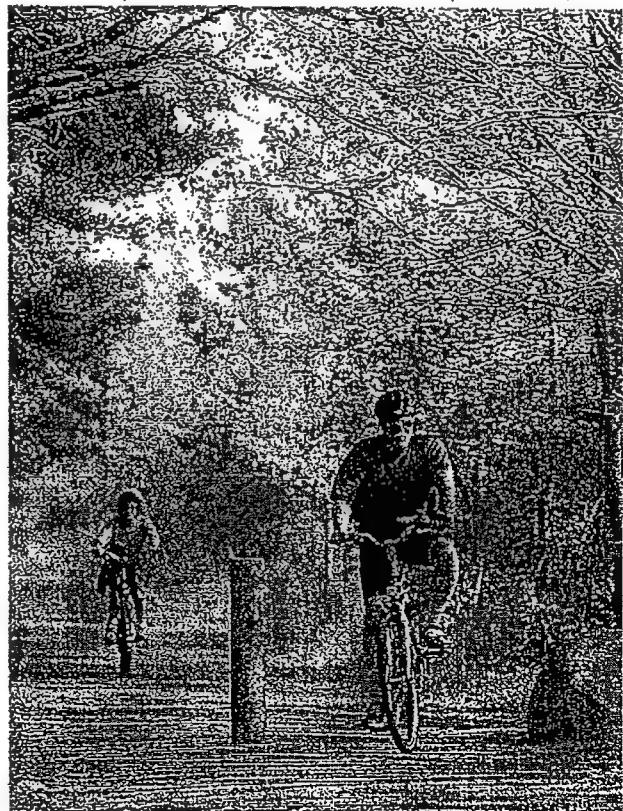
Barry Clayman of South Yarmouth, who owns property by the proposed path, wants assurances that residents would be protected from the noise thousands of bikers would bring.

"The concern to us, and believe me, we are in favor of the bike path, it is just the number of people who will be using it and the noise level," Clayman said in a telephone interview. "Our hope is to get some soundproof fencing because we want to be able to enjoy our property and use the bike path as well."

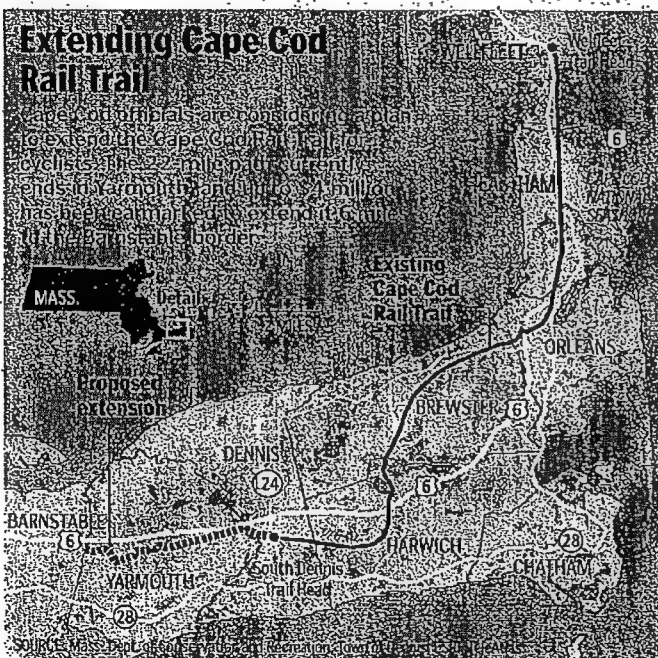
Barnstable County Commissioner Bill Doherty said he wants to see fencing that would not block residents from accessing the path.

"Consider this when assigning fences and barriers," he said at the Sept. 21 meeting. "Homeowners should be given secure or unsecure openings to access trails, and options should be given to horse owners and walkers."

The goal, ultimately, is to connect the 22-mile path to the transportation center in downtown Hyannis, making it easier for tourists to grab their bikes, jump on a train or bus, and hit the trail, said Joe Rodricks, town engineer in Dennis.



Town officials and bicycle enthusiasts hope to extend the trail to the Barnstable border. The goal, ultimately, is to connect



DAIGO FUJIWARA/GLOBE STAFF

"We're trying to make it not a tourist attraction — although it is a great tourist attraction — but a practical tourist attraction," he said at the meeting.

But the trail will not only be for tourists. "We're hoping to get local people to take their bikes from their homes to where they want to go," he said.

Rodricks, who lives in Yarmouth, said more opposition was voiced at the Sept. 20 meeting in Yarmouth because the trail covers a much larger portion of Yarmouth than it does Dennis.

Willow Street, which would be near the path, has recently been widened, he said, and residents who endured the construction there are wondering, "Am I going to get hit [with construction] again?"

"People were worried that crime would increase," he said. "But they realized that it's a secluded railroad that was once wide and open, but will now have

people and activity, and that is of clicked."

Developers are also trying to decide whether to use bridge tunnels to connect the path at bustling intersections. During Sept. 21 meeting, residents are more comfortable riding their bikes on bridges rather than through tunnels, which fear could be used to conduct criminal activity.

While development of project is still in its early stages, about \$3 million to \$4 million has been earmarked by the state, federal government to extend path, said landscape architect John Kissida, who presented plans at the Sept. 21 meeting.

"Now our task is to identify the issues that will be taken up in the final design," he said. "The meetings were very energized. We got a lot of support from the public and can make this a reality but it's going to take some time."

Rail Trail path plan elicits concern

■ Residents worry about safety and the projected extension from Route 134 in South Dennis to Barnstable.

By **PATRICK CASSIDY**
STAFF WRITER

WEST YARMOUTH — A different kind of flyover was the focus of a meeting last night at the police station about building a new section of the Cape Cod Rail Trail.

A digital overview of the trail's potential path from Route 134 in South Dennis to the Barnstable border raised questions and concerns from the audience.

"Somehow you're going to have to protect those of us who are going to have to live with this bike path going right through our backyards," Beacon Street property owner Barry Clayman said.

Other audience members asked the project's design consultants about safety considerations and other uses for the rail, including an equestrian path.

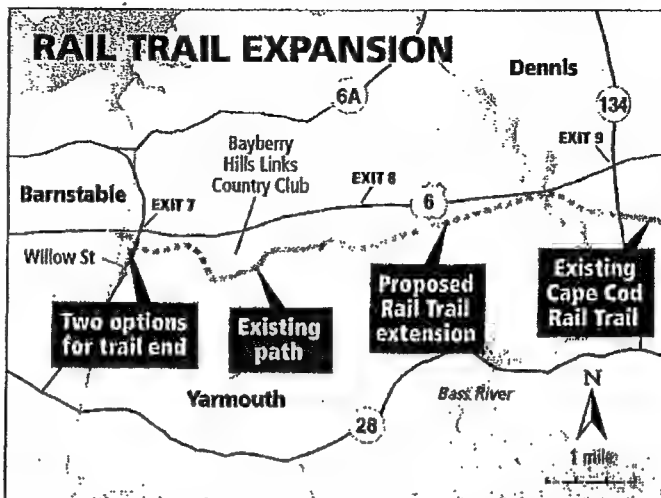
The extension is expected to follow a former railroad bed across the Bass River railroad bridge before traversing Yarmouth south of Route 6.

One of many questions left unanswered is where and how the trail will cross Willow Street and enter Barnstable. The resolution to that challenge depends largely on whether a Barnstable bike and pedestrian



File photo: **RON SCHLOERB**/Cape Cod Times

Cyclists wait to start their bicycle trip at the Dennis entrance to the Cape Cod Rail Trail. A plan to expand the trail westward is the subject of meetings this week.



JOE MYERS/Cape Cod Times

path will connect on the other side of the border, according to Yarmouth Director of Public Works George Allaire. A \$3.2

million federal earmark set aside for the project could be supplemented with other sources of money depending

on cost estimates, Allaire said.

The Massachusetts Highway Department must approve the design and will be responsible for construction, which could begin as early as 2009.

After completion of construction, control of the trail would pass to local municipalities.

A citizens advisory committee is being formed and further public comment is being sought before the formal design process begins, according to the project's consultants.

A second public meeting on the project is set for the Dennis Senior Center on Route 134 at 6:30 tonight.

Patrick Cassidy can be reached at pcassidy@capecodonline.com.

\$3M in federal funds

Rail trail to extend into Yarmouth, Barnstable

By Craig Salters
csalters@cnc.com

After years of planning and preparation, Yarmouth residents have several reasons to believe that the town's anticipated connection to the Cape Cod Rail Trail will come sooner rather than later.

In fact, they have three million of them.

At a joint press conference Monday, Sen. Edward Kennedy, D-Mass., and U.S. Rep. William Delahunt, D-Quincy, announced \$6.2 million in federal funds for the biking and walking trails of Cape Cod. Yarmouth and neighbors Barnstable and Dennis will receive \$3 million to extend the Cape Cod Rail Trail from its current starting point at Route 134 in Dennis to the intermodal transportation center in Hyannis. Falmouth will receive \$3.2 million for the third and final phase of its Shining Sea Bikeway.

"We're making a huge stride in plugging one of the bigger holes in the trail system," said Mark Forest, regional representative for Delahunt, referring to the gap between Dennis and Hyannis, most of which runs

Rail Trail

continued from Page 1

Forest added that, while the Falmouth project is further along in the process, both projects have received "unprecedented support" from residents and were deserving of federal funds. "Our roads are congested enough as it is," said Forest, who noted the potential for increased biking, hiking, walking and even the possibility that more Cape Codders would choose to bike to their workplaces.

Yarmouth DPW Director George Allaire, who has made the extension of the bike trails a department priority, said more work is needed before the five or six miles of new trails became a reality. One hurdle, said Allaire, is that the state's abandonment of railroad right-of-way still needs approval at the national level. Another hurdle, he said, is coordinating the exact trail routes with his colleagues in Dennis and

Barnstable while addressing the traffic issues caused by Route 134 and Route 28.

"My goal is to get to Willow Street," said Allaire.

One big advantage to new trail construction is that, no matter how the trail eventually connects to Hyannis, it will also connect recreation areas at Sandy Pond and Flax Pond with Old Townhouse Park, the start of Yarmouth's existing walking trails.

"That will allow residents access to all three parks with minimal disruption from road traffic," said Allaire.

A five-mile park

From its beginning at Old Town House Park, Yarmouth's current walking/biking trail runs through the transfer station area across Bayberry Hills Golf Course to Higgins Crowell Road.

Yarmouth Recreation Director Pat Armstrong also noted the importance of connecting Sandy Pond and Flax Pond to Old Townhouse Park.

"What we're creating is a five-mile linear park through Yarmouth," said Armstrong, who praised Allaire's foresight in building and revamping what will become spurs to the main trail. "You'll be able to park your car at one site and access all three parks."

What's more, said Armstrong, Yarmouth walkers and bikers will be able to park at any of those three parks and have direct access to the Cape Cod Rail Trail, a 22-mile stretch of paved, flat surface which now runs from Dennis to Wellfleet.

"We're thrilled," said Armstrong, who said that town officials have been working for the better part of a decade to make Yarmouth more of pedestrian-friendly community. "This is going to be phenomenal."

Appendix 7

Meeting Minutes and Presentation Boards

Cape Cod Rail Trail Project Schedule

Citizens Action Committee (CAC) Workshop
(Complete June 2006)

General Yarmouth Informational Meeting
September 20, 2006

General Dennis Informational Meeting
September 21, 2006

**Schematic Concept and Issues Workshop
(Public, Stake Holders, CAC)
November 16, 2006**

MassHighway Kick-Off Meeting
November/December 2006

Citizens Action Committee (CAC) Meeting
December 2006

Dennis/Yarmouth Selectmen's Meeting(s)
January 2007

Yarmouth/ Dennis Preferred Plan Public Meeting
January 2007

Completion of Cape Cod Rail Trail Feasibility
February 2007

CCRT Public Meeting Agenda

September 2006

Introductions

Project Description and Meeting Purpose

Role of the Citizens Advisory Committee

Project Orientation and Overview
(Aerial tour of Anticipated Route)

Introduction of Existing Conditions Analysis

Project Issues

Public Input on Opportunities and Limitations

Anticipated Next Steps and Schedule

CCRT Project Issues

Major and minor street crossing strategies

Design Criteria

Residential Screening, fencing and planting

Bass River crossing improvements

Parking/Rest Stops/Public Restrooms

Way Finding

Connectivity

Equestrian

Interface with Barnstable connections

Route confirmation and refinement

Permitting and Approvals

Project Funding Opportunities

CCRT Schematic Concept and Issues Workshop

November 16, 2006

Meeting Purpose and Introductions by attendees

Project Description and Overview of Work to Date

Project Issues Review

Review of Lessons Learned

(DCR CCRT design, construction and use)

Abutter Issues (during design and construction)

Encroachment/boundary issues

Creating Bikeway Identity;
(need to differentiate town & DCR trail)

Security and Safety

Review of Updates to Existing Conditions Analysis

Presentation of Schematic Design Concept and Considerations

Pathway Alignment Considerations

On Grade and Bridge Crossings

Potential Parking Locations and Capacities

Rest Stop and Restroom Locations

Areas for Consideration of Visual Screening

Connectivity Opportunities

Way Finding Ideas

Equestrian?

Public Input

Schedule Update

VHB/CDM

Design Criteria

Design Speed = 20 MPH (min)

Travel Lanes = 5 ft (min)

Shoulder = 2 ft (min)

Horizontal Clear. = 3 ft

Vertical Clear. = 8 ft (min)

Cross Slope = $\frac{1}{4}$ in. / ft.

Horizontal Radius = 100 ft (@20mph)

Grades = 11% (max.)

High of Eye = 4.5 ft

High of Object = 0.0 ft

Sight Distance = 120 ft (up); 160 ft (down)

Project Funding Opportunities

FHWA Enhancement Program

Greenway Grants (DuPont/Kodak)

SAFETEA-LU –Earmarked Funds

Chapter 90 and other local funds

Impact Fees (i.e. through the RPA)

Mitigation Fees (through local boards)

Urban Park and Recreation Recovery Program
(Federal)

Land and Water Conservation Fund (Federal)

Urban Self Help Program (Massachusetts)



Vanasse Hangen Brustlin, Inc.

101 Walnut Street
Post Office Box 9151
Watertown, MA 02471-9151
Telephone (617) 924-1770
Fax (617) 924-2286

Meeting Notes

Attendees: Robert Burgmann; Barnstable
George Allaire; Yarmouth
Joseph Rodricks; Dennis
Tom Jackmin; VHB Structures
Matt Hayes; VHB Civil
John Coco; VHB Civil
Steve Farr; VHB Civil
John Kissida; CDM
Dwight Dunk; CDM Env.
Joe Magni, VHB

Date/Time: March 31, 2006

Project No.: 09794/09794.01

Place: VHB Naimo Board Room

Re: Kick-off Meeting: Cape Cod Rail Trail
Extension

Notes taken by: J. Magni

This meeting was held as a kickoff meeting intended to detail for the design team the project mission, project purpose and need, stakeholders, and project issues. The following issues were discussed:

I. Team Members:

- Yarmouth:
 - George Allaire: Prime Client contact
 - Rick deMello: Technical Review – Field Survey
 - Bruce Barrows: Base Survey Plans
- Dennis:
 - Joseph Rodricks: Prime Client Contact
- Barnstable
 - Robert Burgmann: Prime Town Contact
- CDM
 - John Kissida: Task Leader
 - Dwight Dunk: Environmental
- VHB
 - Joe Magni- Civil Task Leader
 - Steve Farr- Civil
 - Matt Hayes- Civil
 - Tom Jackmin-Structures
 - Paul Nauyokas- Traffic

II. Project Mission/Goals:

- a. Mission: In a collaborative and cooperative setting, plan a world class multi-use pedestrian trail that provides safe and convenient access to recreational and institutional destinations in Dennis and Yarmouth for regional and local users.

b. Goals:

- i.** Create a "linear park" image for the Cape Cod Rail Trail Extension in Yarmouth and Dennis between Rte 134 and the west side of Willow Street that can connect to the trail system planned for Barnstable; and
- ii.** Develop a Cape Cod Rail Trail Extension plan that provides safe and convenient connections to the recreational and institutional destinations along the proposed multiuse path alignment in Yarmouth; and also at the Bass River Railroad bridge crossing

III. Connection Locations

- a.** Dennis Town Offices
- b.** Johnny E. Kelly Park
- c.** Indian Lands west of Dennis Town Offices
- d.** DEM lands located in Barnstable
- e.** Multi-use Path on Forest Road
- f.** Future Multi-use Path on Higgins Crowell Road
- g.** Residential Community
- h.** Access to Beaches
- i.** Historic South Dennis
- j.** Flax Pond Beach/Recreation Area
- k.** Station Ave Elementary School
- l.** Dennis-Yarmouth Regional High School
- m.** Old Town House Road Recreational Area at the Town Disposal Area
- n.** Bayberry Hills Golf Course
- o.** Marguerite E. Small Elementary School
- p.** Mattacheese Middle School
- q.** West Sandy Pond Beach/ Recreation Area
- r.** Future potential parking areas to support the trail
- s.** At Yarmouth Border to the Barnstable trail system with potential connections to the Route 6 Service Road and Transportation Center.

IV. Stake Holders

- a.** Yarmouth, Dennis, Barnstable Selectmen
- b.** Yarmouth, Dennis, Barnstable residents
- c.** Citizen Advisory Group
- d.** Yarmouth and Dennis Conservation Commissions
- e.** Comm. Of Mass EOT/ MassHighway\
- f.** Yarmouth Water District
- g.** Yarmouth and Dennis Recreation Dept.
- h.** Bayberry Golf Course
- i.** Mass Fish and Wildlife
- j.** Rail Company – Solid Waste Contractor
- k.** Barnstable Land Trust
- l.** Bay Colony Rail
- m.** Cape Cod Railroad
- n.** Mass Bike and other special interest bike groups
- o.** Equestrian Community
- p.** Dennis Road Safety Task Force
- q.** S. Dennis Historical District
- r.** Dennis Transportation Master Plan

V. Advisory Committee

- a.** Role: The role of the membership of the Yarmouth-Dennis Citizens Advisory Committee involves participation in periodic meeting with the Town's project proponents and professional designer to assist in the development of variety of trail elements including the following:

- i.** Residential Screening
- ii.** Planting/landscaping
- iii.** Parking/Rest Stop
- iv.** Way Finding Kiosks
- v.** Connectivity
- vi.** Development of an "Adopt a Bike Path" maintenance program
- vii.** Selection of fence/barrier styles
- viii.** Cultural wayside exhibits
- ix.** Members may included, but not be limited to, residential and commercial residents abutting the property, local safety officers, representatives of the local Traffic Committee, Schools, and Recreational Areas, Local Bike Club representatives, and regional planners (CCC).

VI. Public Outreach Program

a. CCRT Committees

- i.** Dennis Sub-Committee
- ii.** Yarmouth Sub-Committee
- iii.** Lindsey Counsell, Director of Environmental Services
Growth Management Department
367 Main Street
Hyannis, MA 02601
(508) 862-4675
[www.lindsey.counsell@town.barnstable.ma.us](mailto:lindsey.counsell@town.barnstable.ma.us)
- iv.** Yarmouth & Dennis Safety officers
- v.** Yarmouth & Dennis Fire Department Representatives

b. Tentative Meeting Schedule

- i.** Kickoff meeting with **MassHighway**
- ii.** **CAC** Sub-Committee Workshop (Mid-May)
- iii.** General Dennis/Yarmouth Information Meeting (Early June)
- iv.** Conceptual Workshop (Mid June)
 - 1.** Public
 - 2.** Stake holders
 - 3.** CAC
- v.** Update meeting with **MassHighway** (mid September; if required)
- vi.** **CAC** Sub-Committee Meeting (Mid September)
- vii.** Combined Dennis/Yarmouth Selectmen's Meeting
- viii.** Preferred Plan Public Meeting (Late October)

VII. Project Schedule

- a.** The Project Schedule presented at this kick-off meeting will be updated after all survey and base plans are complete and also after our first round of sub-committee meetings.

VIII. Previous Studies

- a.** Yarmouth Regional BP Concept – 1986
- b.** Willow Street Crossing Feasibility Study
- c.** Station Ave Crossing Feasibility Study
- d.** Cape Cod Rail Trail-Clemson University
- e.** CCRT Trans. Improve Project –DCR
- f.** Barnstable Airport Master Plan
- g.** Barnstable Multi-Modal Trans Center
- h.** Yarmouth/Dennis/Barnstable Local Comprehensive Plan
- i.** Yarmouth/Dennis/Barnstable Open Space and Recreation Plan

IX. Potential Rest Stops

- a.** Adjacent to Cemetery and Town Hall Parking
- b.** Indian Land Reserve
- c.** Bass River/Route 6 abandoned rest stop (Obtain existing site plans)
 - i.** Access from Rte 6
 - ii.** Under MassHighway Control
 - iii.** Consider using for project Staging
- d.** Public land west of Station Ave.
- e.** Rest Stop details
 - i.** Extension of existing parking lot
 - ii.** Way Finding to Lot
 - iii.** Information Kiosk
 - iv.** Bike Racks
 - v.** Rest Stop Staging area
 - vi.** Mile Marker/Location Marker

X. Railroad Issues

- a.** Bay Colony Lease ends 6/30/2006 & property is abandoned as rail function
- b.** New Lease –BP limits from Station Ave to Bass River not in new lease
- c.** EOT soliciting permission to allow BP construction
- d.** EOT soliciting permission to allow BP clearing, survey and studies.

XI. Critical Locations

- a.** Rte 134- Dennis
 - i.** 80 ROW
 - ii.** 66' of pavement
 - iii.** 8' Walk on east side
 - iv.** Rte 134 VHB Design Plans
 - v.** Tunnel or Bridge
 - vi.** Bike Path to share ROW with Trash Train
 - vii.** Shared ROW begins 1000' west of Station Ave.
 - viii.** Switchback is active
 - ix.** 10' offset from Rail Centerline to BP Shoulder
 - x.** BP- Railroad Barrier (Fencing)
- b.** Main Street – Dennis
 - i.** VHB Intersection Improvement Plan
 - ii.** Sight Distance –Southbound approach
 - iii.** High Speeds
 - iv.** Solar Traffic/Pedestrian Signals
 - v.** Button-Hook Stop Condition
 - vi.** Speed Table – Traffic Calming
- c.** Bass River Crossing @ town line
 - i.** Scenic overlook
 - ii.** Consider fishing Dock
 - iii.** Anticipate pre-engineered structure for bridge crossing
 - iv.** Army Corps Studies – Hydraulic
 - v.** Reuse of existing Structure
 - vi.** Replacement superstructure
 - vii.** Substructure
 - viii.** Wetlands/Salt Marsh/Annual Fish Migration
 - ix.** Permitting Requirements
- d.** Whites Path @ North Main Street
 - i.** VHB Intersection Improvement Plan
 - ii.** Sight Distance
 - iii.** High Speeds

- iv. Solar Traffic/Pedestrian Signals
 - v. Button-Hook Stop Condition
 - vi. Speed Table – Traffic Calming
 - vii. Strobe Light
- e. Station Ave
 - i. 60 Foot ROW
 - ii. 48' of pavement
 - iii. Level Approaches
 - iv. Station Ave VHB Design Plans Available
 - v. Tunnel or Bridge?
- f. Existing Pat through Bayberry golf course
 - i. Existing Wetland
 - ii. Guard Rail Rub Rail
 - iii. Existing well fields
 - iv. Consider safer intersections with golf paths
 - v. Consider micro-surfacing existing path
 - vi. Fence and wall encroachments exist along the path.
- g. Willow Street
 - i. High ground water elevation
 - ii. Limited to bridge crossing
- h. Barnstable Connection
 - i. Fish & Wildlife Property (No Signage or asphalt pavement)
 - ii. 3 Yarmouth Parcels(4th parcel to be purchased in the future)
 - iii. Connection to Service Road
 - iv. Connection to Multi-modal Center
 - v. Wetland on NSTAR Property near Camp Street
- i. Business Connections
 - i. Bike Shop @ Rte 134
 - ii. Mid-Cape Racket Center
 - iii. Department of Conservation & Recreation
 - iv. Yarmouth Water Division
 - v. Barnstable Growth Mgmt
- j. Intersection control Options
 - i. Switch Backs
 - ii. Button Hooks
 - iii. Bollards
 - iv. Highway/Pedestrian Signals
 - v. Signal Warrants
 - vi. Bike Path Traffic Volumes

XII. Project Fencing

- a. Access to properties
- b. Summer Surveillance
- c. Bike Advocates and Neighboring Police Chiefs at Public Meeting
- d. Establish Criteria for Fencing, i.e.
 - i. Building Proximity
 - ii. Sensitive Receptors
 - iii. Dangerous Conditions

XIII. Action Items

- a. Copy of relevant reports to Project Team
- b. Schedule meeting date(s) for team site walks
- c. Schedule first CAC Workshop
- d. Produce Base Plans prior to site walks
- e. Meet with MassHighway to discuss concepts and controlling criteria

f. Obtain DCR CCRT Improvement Plans

CCRT Extension Feasibility Study

Kick-Off Meeting

March 31, 2006

Team Members

- Yarmouth:
 - George Allaire: Prime Client contact
 - Rick deMello: Technical Review – Field Survey
 - Bruce Barrows: Base Survey Plans
- CDM
 - John Kissida: Task Leader
 - Dwight Dunk: Environmental
- VHB
 - Joe Magni- Civil Task Leader
 - Steve Farr- Civil
 - Matt Hayes- Civil
 - Tom Jackmin-Structures
 - Paul Nauyokas- Traffic

Project Mission

- **Mission Statement:** In a collaborative and cooperative setting, plan a world class multi-use pedestrian trail that provides safe and convenient access to recreational and institutional destinations in Dennis and Yarmouth for regional and local users.

Project Goals

- Project Goals:
 - Create a “linear park” image for the Cape Cod Rail Trail Extension in Yarmouth and Dennis between Rte 134 and the west side of Willow Street that can connect to the trail system planned for Barnstable; and
 - Develop a Cape Cod Rail Trail Extension plan that provides safe and convenient connections to the recreational and institutional destinations along the proposed multiuse path alignment in Yarmouth; and also at the Bass River Railroad bridge crossing.

Stake Holders

1. Y & D Selectmen
2. Y & D residents
3. Citizen Advisory Group
4. Barnstable DPW and Residents
5. Y & D Conservation Commissions
6. Comm. Of Mass EOT
7. Yarmouth Water District
8. Y & D Recreation Dept.
9. Bayberry Golf Course
10. MassHighway
11. Mass Fish and Wildlife
12. Rail Company – Solid Waste Contractor
13. --
14. --
15. --

Project Connectivity

- Flax Pond Beach/Recreation Area
- Station Ave Elementary School
- Dennis-Yarmouth Regional High School
- Old Town House Road Recreational Area at the Town Disposal Area
- Bayberry Hills Golf Course
- Marguerite E. Small Elementary School
- Mattacheese Middle School
- West Sandy Pond Beach/ Recreation Area
- Future potential parking areas to support the trail
- At Yarmouth Border to the Barnstable trail system with potential connections to the Route 6 Service Road and Transportation Center.

Advisory Committee

- **Role of the Citizen Advisory Committee**

- The role of the membership of the Yarmouth-Dennis Citizens Advisory Committee involves participation in periodic meeting with the Town's project proponents and professional designer to assist in the development of variety of trail elements including the following:
 - Residential Screening
 - Planting/landscaping
 - Parking/Rest Stop
 - Way Finding Kiosks
 - Connectivity
 - Development of an "Adopt a Bike Path" maintenance program
 - Selection of fence/barrier styles
 - Cultural wayside exhibits
 - Members may included, but not be limited to, residential and commercial residents abutting the property, local safety officers, representatives of the local Traffic Committee, Schools, and Recreational Areas, Local Bike Club representatives, and regional planners (CCC).

Public Outreach Program

- Initial Public Meeting W/ CAC
- Presentation of Alternatives/Feasibility
- MassHighway Coordination

Project Schedule

- (SEE GRAPHIC SCHEDULE)

Previous Studies

- Yarmouth Regional BP Concept – 1986
- Willow Street Crossing Feasibility Study
- Station Ave Crossing Feasibility Study
- Cape Cod Rail Trail-Clemson University
- CCRT Trans. Improve Project –DCR
- Barnstable Airport Master Plan
- Barnstable Multi-Modal Trans Center

Study Outline

1. Executive Summary
2. Project Goals
3. Description of Existing Conditions
4. Description of Proposed Improvements
5. Outline of BP Design Criteria and Cross Sections
6. Identification alternatives studies
7. Alternatives Analysis
8. Outreach Program-Consensus
9. Conclusions & Recommendations
10. Construction Estimate of Cost – Preferred Alternative
11. Appendices (Mtg. Minutes, traffic data, agency correspondence)

Rte 134 - Dennis

- 80 ROW
- 66' of pavement
- 8' Walk on east side
- Rte 134 VHB Design Plans
- Tunnel or Bridge



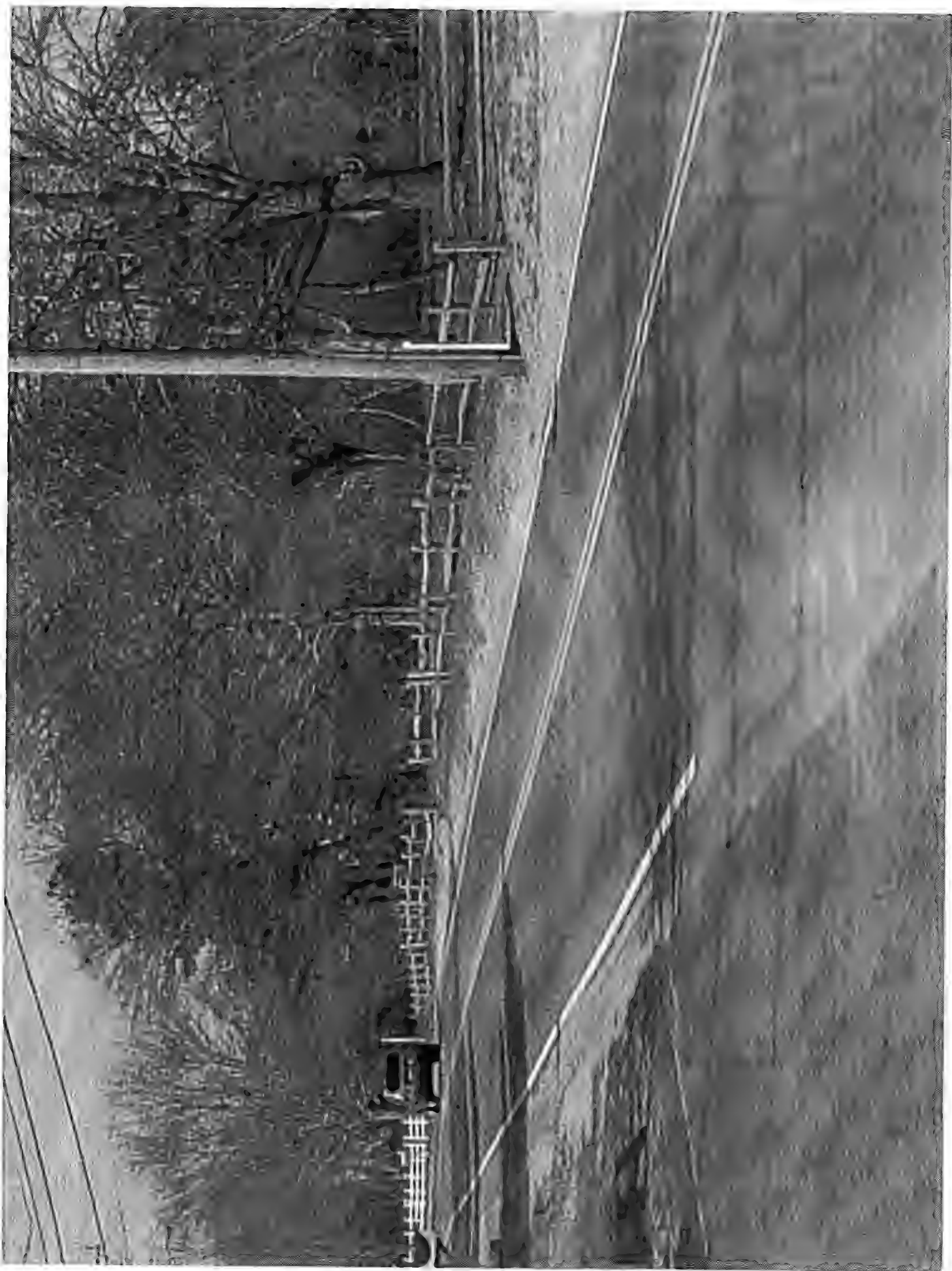




Main Street -Dennis

- VHB Intersection Improvement Plan
- Sight Distance –Southbound approach
- High Speeds
- Solar Traffic/Pedestrian Signals
- Button-Hook Stop Condition
- Speed Table – Traffic Calming





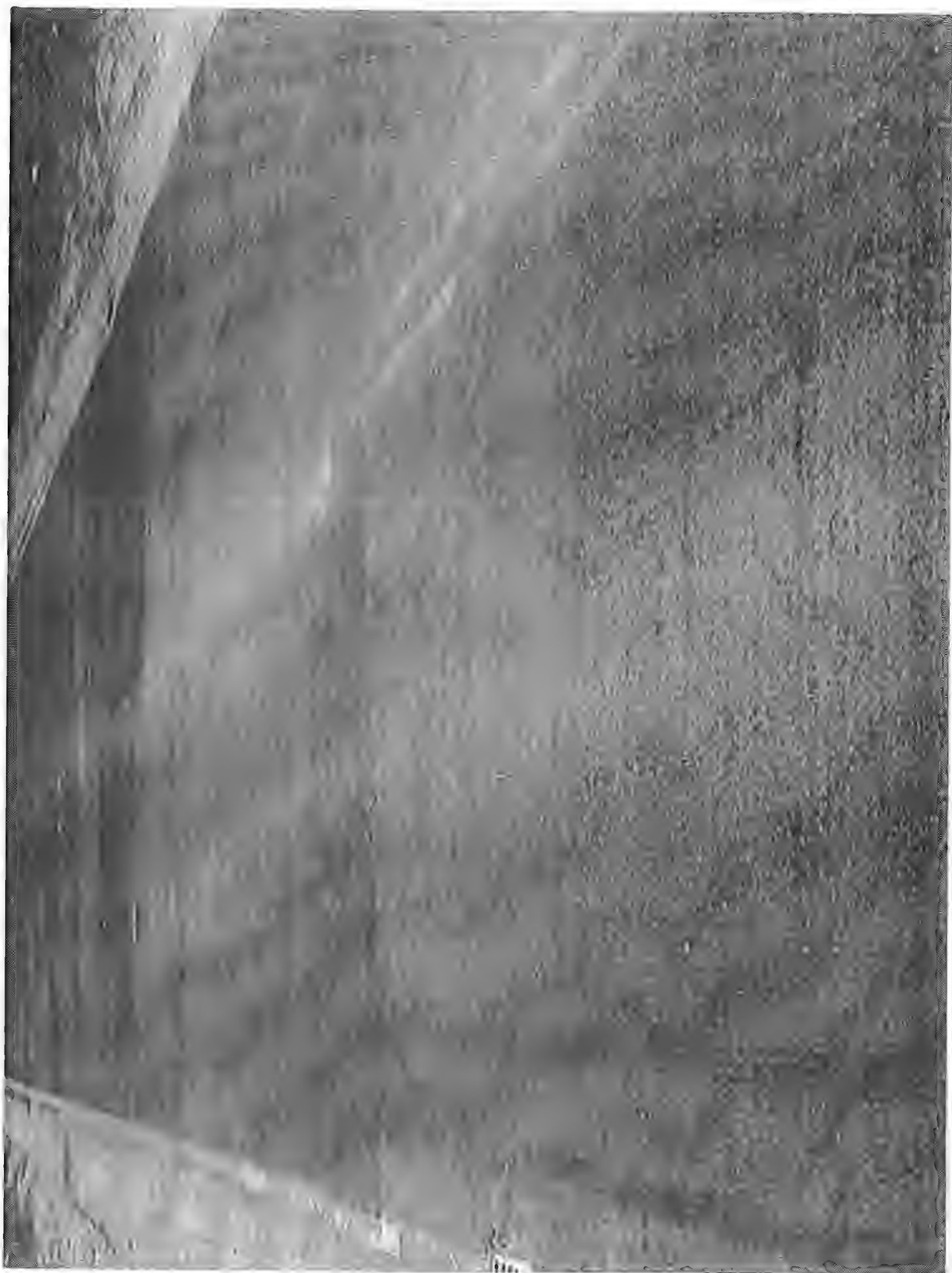
Potential Rest Stop

- Adjacent to Cemetery and Town Hall Parking
- Indian Land Reserve
- Public Opposition

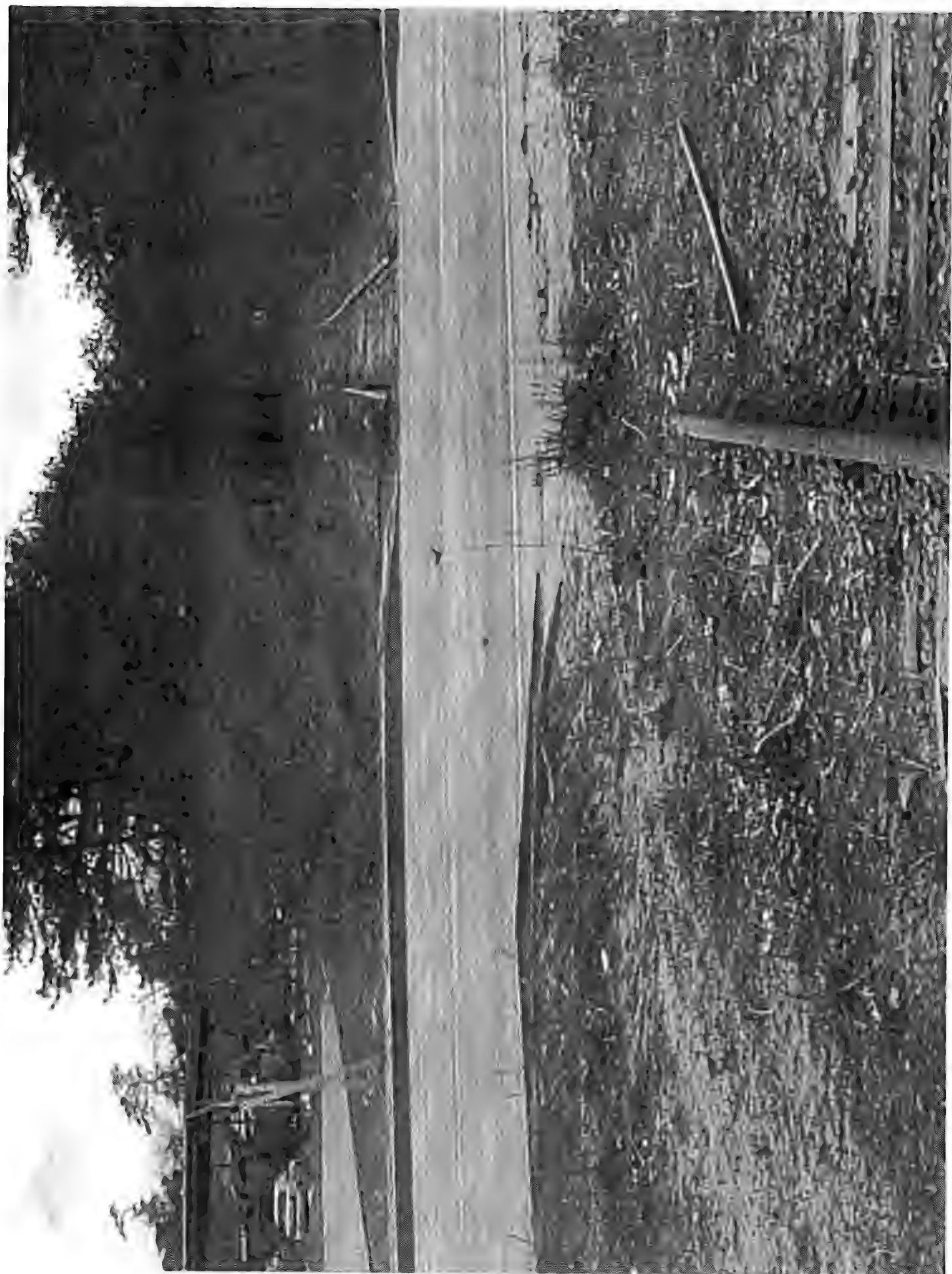


Whites Path @ N. Main Street

- VHB Intersection Improvement Plan
- Sight Distance
- High Speeds
- Solar Traffic/Pedestrian Signals
- Button-Hook Stop Condition
- Speed Table – Traffic Calming
- Strobe Light







Station Avenue

- 60 Foot ROW
- 48' of pavement
- Level Approaches
- Station Ave VHB Design Plans Available
- Tunnel or Bridge?







Bass River Crossing

- Army Corps Studies – Hydraulic
- Reuse of existing Structure
- Replacement superstructure
- Substructure
- Wetlands/Salt Marsh/Annual Fish Migration
- Permitting Requirements









Bass River Rest Stop

- Access from Rte 6 (the Mid-Cape)
- MassHighway Control
- Seek Permission to use as a BP Staging area



Workshop Road Rest Stop

- Extension of existing parking lot
- Way Finding to Lot
- Information Kiosk
- Bike Racks
- Rest Stop Staging area
- Mile Marker/Location Marker





Rail Road Issues

- Bay Colony Lease ends 6/30/2006
 - Property is abandoned as rail function
- New Lease
 - Station Ave to Bass River not in new lease
- EOT soliciting permission to allow BP construction
- EOT soliciting permission to allow BP clearing, survey and studies.

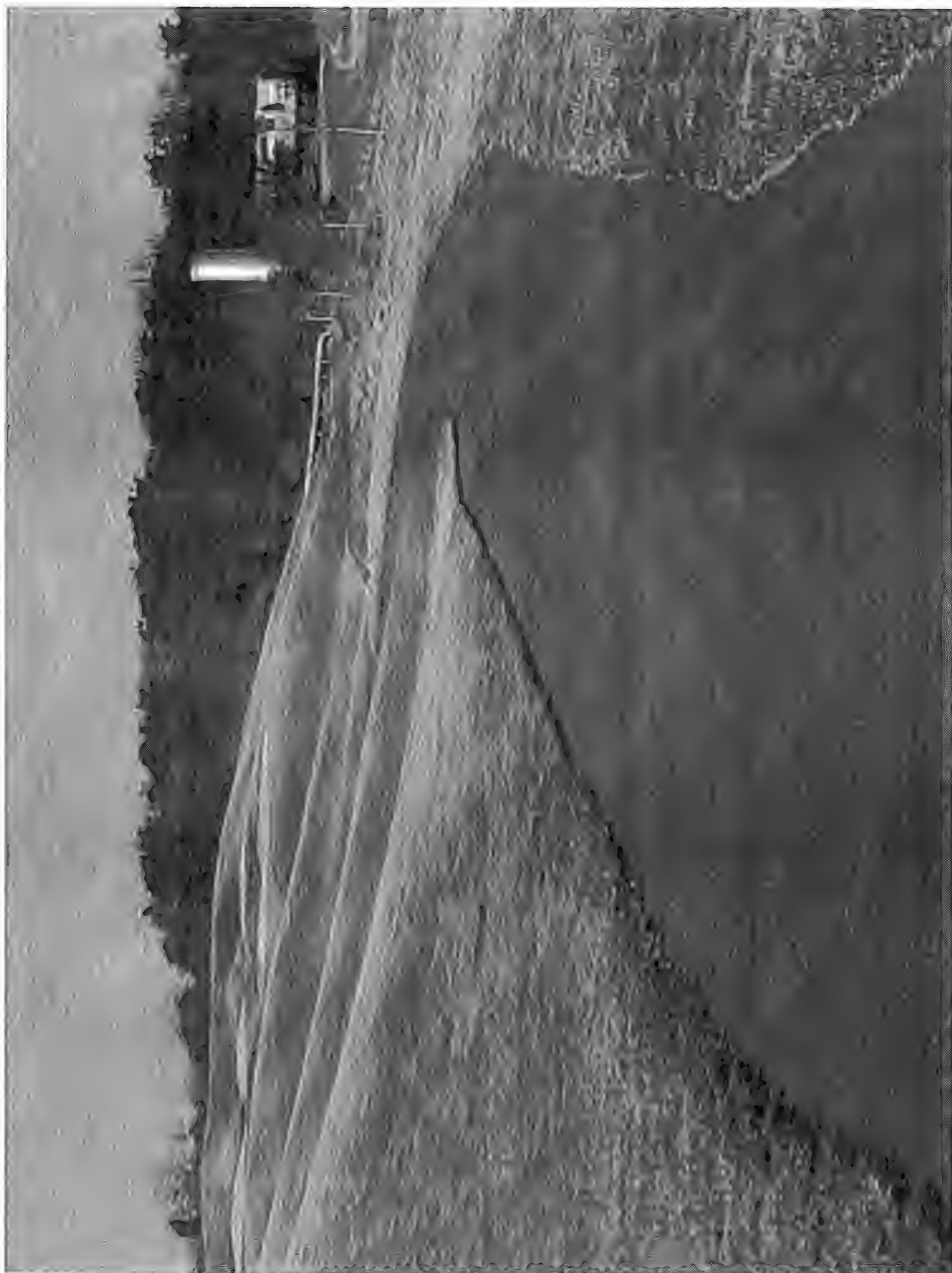
Rails w/ Trails

- Bike Path to share ROW with Trash Train
- Shared ROW begins 1000' west of Station Ave.
- Switchbacks
- 10' offset from Rail Centerline to BP Shoulder
- BP- Railroad Barrier (Fencing)



Existing Path Thru Golf Course

- Varies in width
- Existing Wetland
- Guard Rail Rub Rail



West of OLHR Park

- Chain Link Fence encroaches corridor
- Existing Wall is on Property Line
- Micro-Surface existing Park BP





Intersection Control

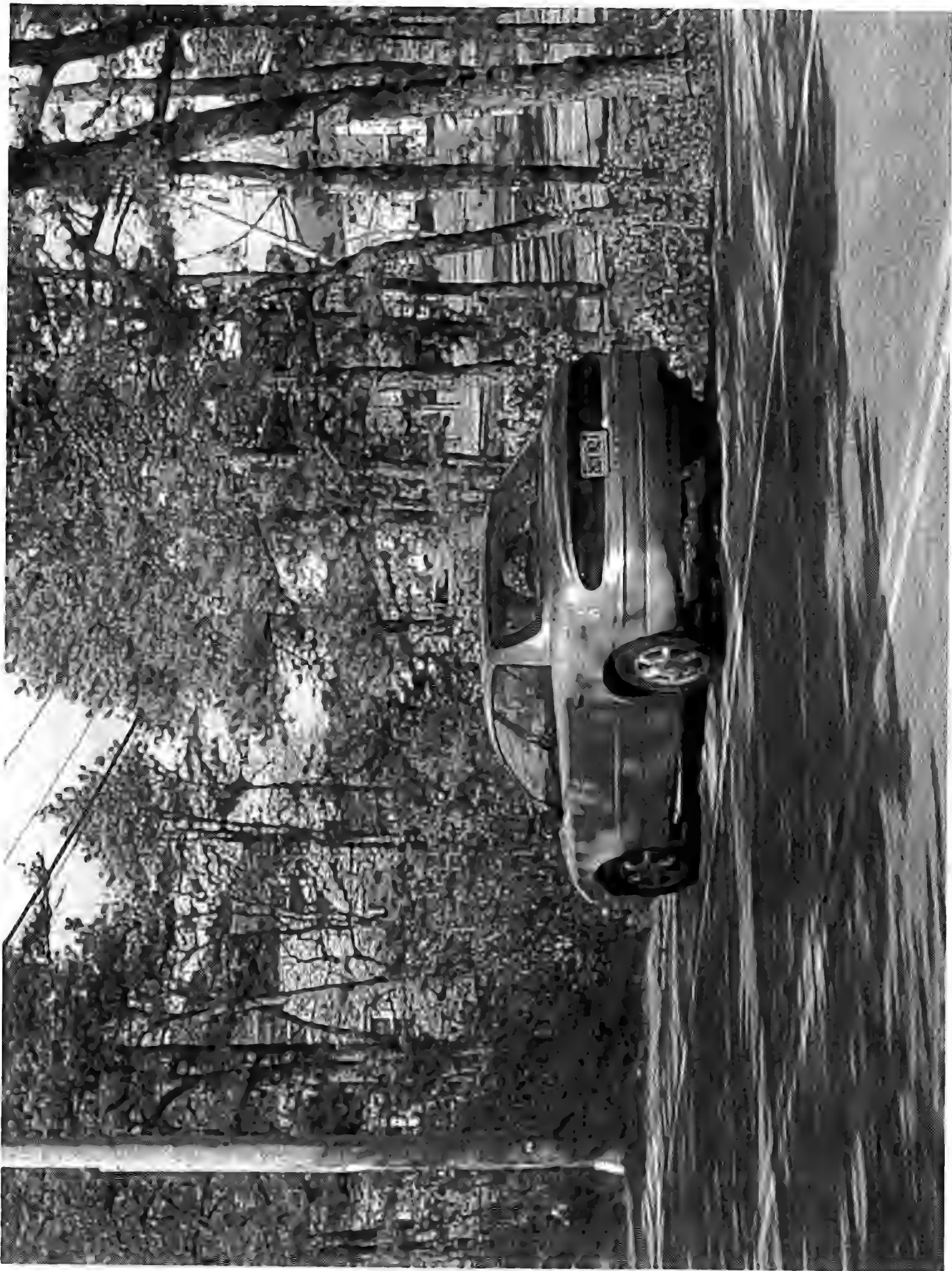
- Switch Backs
- Button Hooks
- Bollards
- Highway Signing
- Ped Signals





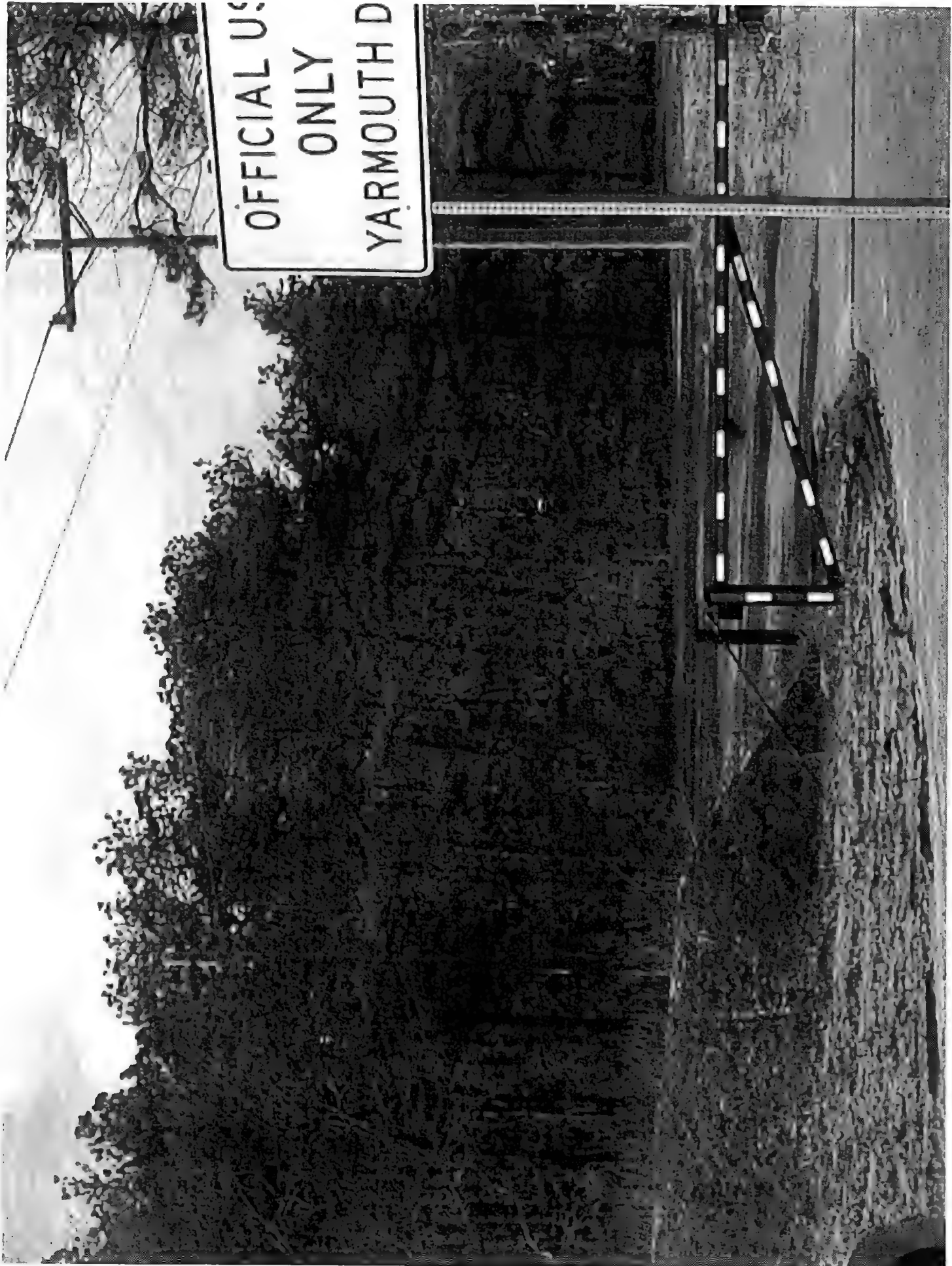






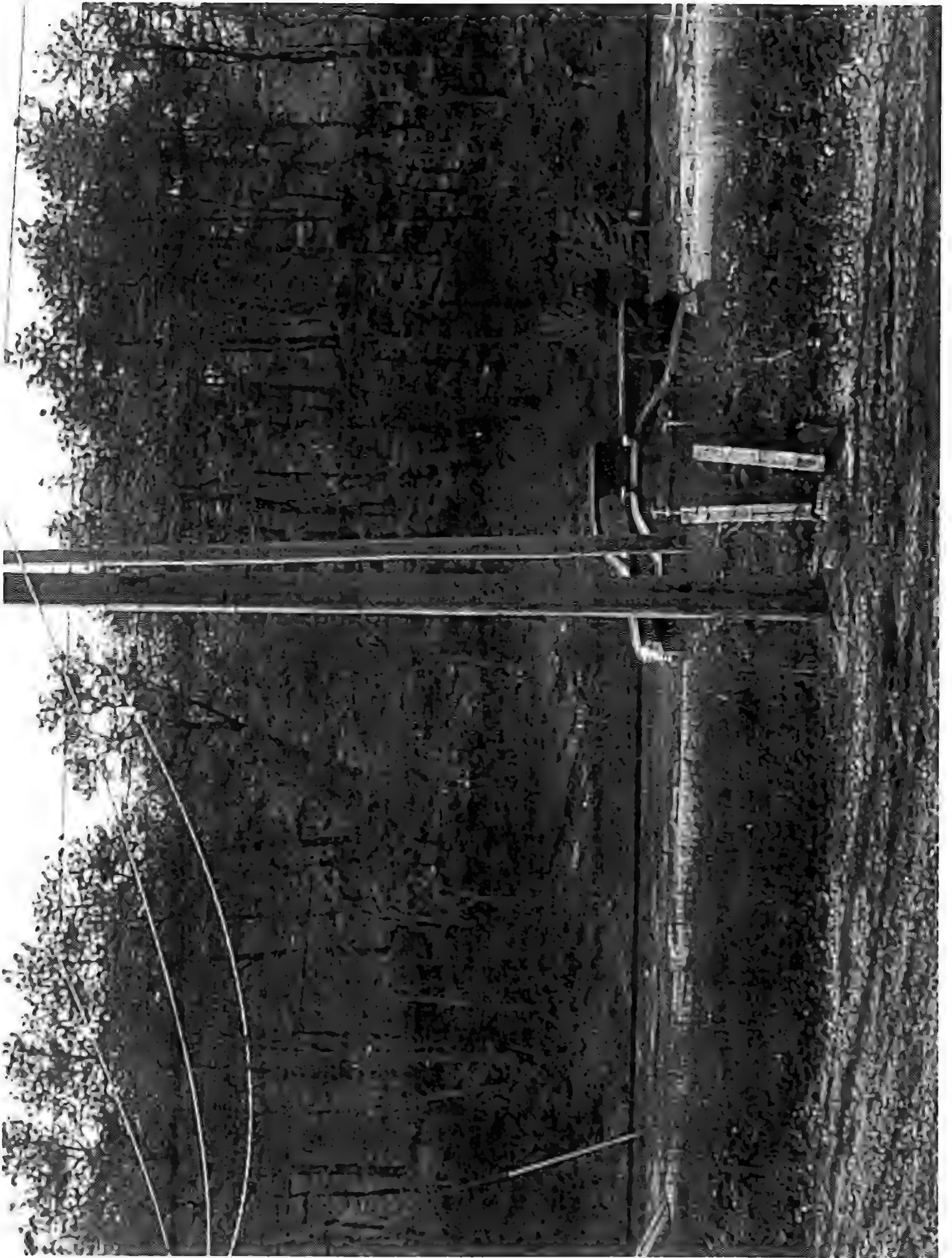


OFFICIAL USE
ONLY
YARMOUTH D



Willow Street

- Ground Water at -5 Feet
- Bridge or at-grade crossing only.







Barnstable Connection

- Fish & Wildlife Property (No Signs or HMA)
- 3 Yarmouth Parcels(4th to be pruchased)
- Connection to Service Road
- Connection to Multi-modal Center
- Wetland on NSTAR Property near Camp Street

Project Fencing

- Access to properties
- Summer Surveillance
- Bike Advocates and Neighboring Police Chiefs at Public Meeting
- Establish Criteria for Fencing
 - Building Proximity
 - Sensitive Receptors
 - Dangerous Conditions

Other Design Issues

- Obtain DCR CCRT Improvement Project Plans
- Mile Marker concept; i.e. D-4 or Y-2
- Button Hook Terminus
- Access to ROW for data Collection

Solar Panel Pedestrian Signals

- Solar Panel Pedestrian Signals or 4-Way Stop?
 - Main Street-Dennis
 - Higgins Crowell Road
 - N. Main Street @ Whites path
 - Forest Road Extension
 - West Yarmouth Road



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Meeting Notes

Attendees: See Attached Sign-In Sheet

Date/Time: September 20, 2006; 6:30 pm

Project No.: 0979400

Place: Yarmouth Police Station

Re: Cape Cod Rail Trail - Dennis/Yarmouth

Notes taken by: Stephen Farr

Yarmouth DPW Director, George Allaire began the meeting with an opening statement and introduced John Kissida from CDM and Joe Magni from VHB who went through the following Agenda and Project Boards in regards to Feasibility Study.

CCRT Public Meeting Agenda September 2006

Introductions

Project Description and Meeting Purpose

Role of the Citizens Advisory Committee

Project Orientation and Overview
(Aerial tour of Anticipated Route)

Introduction of Existing Conditions Analysis Plans

Project Issues

Public Input on Opportunities and Limitations

Anticipated Next Steps and Schedule

VHB/CDM

CCRT Project Issues

Major and minor street crossing strategies

Design Criteria

Residential Screening, fencing and planting

Bass River Crossing improvements

Parking/Rest Stops/Public Restrooms

Permitting and Approvals

Way Finding

Connectivity

Equestrian

Interface with Barnstable connections

Route confirmation and refinement

Project Funding Opportunities

VHB/CDM

CCRT Design Criteria

Design Speed = 20 MPH (min)

Travel Lanes = 5 ft (min)

Shoulder = 2 ft (min)

Horizontal Clear. = 3 ft

Vertical Clear. = 8 ft (min)

Cross Slope = $\frac{1}{4}$ in. / ft.

Horizontal Radius = 100 ft (@20mph)

Grades = 11% (max.)

High of Eye = 4.5 ft

High of Object = 0.0 ft

Sight Distance = 120 ft (up); 160 ft (down)

VHB/CDM

Funding

FHWA Enhancement Program
Greenway Grants (DuPont/Kodak)
SAFETEA-LU –Earmarked Funds
Chapter 90 and other local funds
Impact Fees (i.e. through the RPA)
Mitigation Fees (through local boards)
Urban Park and Recreation Recovery Program (Federal)
Land and Water Conservation Fund (Federal)
Urban Self Help Program (Massachusetts)

Cape Cod Rail Trail Project Schedule

Citizens Action Committee (CAC) Workshop
General Yarmouth Informational Meeting
General Dennis Informational Meeting
Conceptual Workshop (Public, Stake Holders, CAC)
MassHighway Kick-Off Meeting
Citizens Action Committee (CAC) – Sub-Committee Meeting
Dennis/Yarmouth Selectmen's Meeting(s)
Yarmouth /Dennis Preferred Plan Public Meeting(s)
Completion of Cape Cod Rail Trail Feasibility Study

Completed June 2006)
September 20, 2006
September 21, 2006
October /November, 2006
November, 2006
December, 2006
January , 2007
January, 2007
February, 2007

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The Presentation was followed by a Question & Answer segment which featured comments and concerns from the following attendees:

Questions:

Barry Clayman, 90 Beacon Street;

- Asked if the designers were providing "protection" to those properties directly abutting the bikepath.
- Stated the potential for additional "noise pollution" and "trespassing" from bikepath users.
- The project team responded that fences and landscape screening would be used selectively on a case by case basis to mitigate the potential for the issues cited above.
- Would "protective fencing" to prevent debris being thrown from bicycle bridges over the roadway be installed?
- The project team responded that special fencing to prevent pedestrians from throwing debris or jumping off the bridges would be installed.

Harry Walker, 126 Beacon Street;

- Requested that consideration be given to keeping any equestrian path and/or the entire bikepath as far to the north within the right of way as possible to give the Beacon Street residents the maximum amount of buffer.
- Stated that it was his desire not to have a fence installed adjacent to his property.

Jim Cipro, 68 Beacon Street;

- Parking restrictions at the end of Beacon Street should be considered to prevent bikepath users from using the end of Beacon Street as access to the bikepath through private property.
- Stated that he would desire fencing adjacent to his property but with a gate for his own use.

Mary Overiston, 454 North Main Street;

- Asked if the existing railroad Right of Way was large enough for the bikepath?
- The project team responded that the existing Right of Way is approximately 80 feet and that the bikepath including shoulders and side slopes would impact no more than 40-50 feet maximum.

John Hartjen, 44 Grace Ave.;

- Stated that the bikepath needs to have a specific destination point and not "just end" on the Barnstable side of Willow Street.
- Concerned about required clearing for bike path and impact on neighborhood and playground since significant tree removal has already occurred with Willow Street widening
- Stated it will be important to separate pedestrian from RR track
- Noted problem with Bass River RR Bridge and that it impedes navigation

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John Powers, 77 Archibald Circle

- Stated that the designers should consider that "at-grade" crossings of minor streets by bikepath traffic often causes substantial delay to motorized traffic due to the high volumes of users on the bikepath.
- Requested that consideration be given to providing access to Barnstable Center from the bike path.

- Raised concern with tree roots under pathway. The project team indicated this would be addressed
- Noted importance of Barnstable connection

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Mike McMahon, Oak Ave.,

- Requested that the designers consider crossing Willow Street farther to the south, closer to the airport as an alternative and avoiding Airport Runway area.
- The project team explained that a crossing closer to the airport was considered and that due to the presence of wetlands, a narrower right of way and the proximity to the airport which places limitations on the height of bridge structures in that area prompted the design team to favor crossing farther north.

Marsha Ahern, 6 Aster Way,

- Requested that if new restroom facilities are proposed that they be kept as far away from residences as possible.
- The project team responded that no new restroom facilities are planned as part of the bikepath but the existing facilities would be identified on signage at rest stops and street crossings, and that there were several available.

Gail Clayman, 90 Beacon Street,

- Will the Yarmouth Police actively patrol the new bikepath.
- Officer Paul Rooney of the Yarmouth Police Dept. responded that the Yarmouth Police currently has several bicycles and motorized "All Terrain Vehicles" (ATV's) that they intend to employ in the routine patrol of the bikepath.

David Grew, 438 Weir Road,

- What is the expected completion date of the bikepath?
- The design team responded that final plans will be complete by early 2009 and that MassHighway will begin construction of the project sometime during that calendar year.
- Concerned that Atlantic Ave (warehouse area near where train stops), will become a cut thru for public to get to bike way would like fencing considered to restrict access from end of the street.

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Bob Phillips, 32 Ice House Road,

- Have existing abutters encroached upon the Railroad Right of Way and will they be notified prior to construction?
- The design team responded that there have been some encroachments onto the Right of Way and that some of the abutters have already been notified in writing.

Tom Deltz, 24 Blue Rock Road, (owns bike shop on RT 134 in W Dennis)

- What is the total impact or footprint of the bikepath?
- The design team responded that including the sideslopes for re-grading there may be selective areas where the impact is up to 50-feet in total width. However, this is still well below the existing Right of Way width of 80 feet.
- Questioned need for equestrian path

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- Will there be another parking area on west side of RT 134. Design team said that it had not been determined and would depend on impacts to the existing parking area on the east side and the crossing impacts to that parking area.

Barry Clayman, 90 Beacon Street,

- What are the requirements to install safety fencing along the bikepath?
- The design team responded that there are several factors that need to be considered prior to proposing safety fencing adjacent to the bikepath. Some of the considerations include the adjacent sideslope (steeper than 3:1 increases the need), vertical drop-off from the path to the bottom of slope (greater than 4 feet increases the need), the width of the shoulder area (5 feet or greater reduces the need), vegetation adjacent to the path and along the slope (dense shrubs and vegetation reduces the need), and potential hazards at the bottom of the slope (water, rocks or other potentially hazardous surface increases the need for fencing).

Cassandra Koenen, 17 Black Duck Lane,

- Will the Old Townhouse Road path remain, specifically through the ball fields adjacent to the water treatment facility?
- The design team responded that the path referred to will remain.
- Ms Koenen suggested that dogs are not allowed on those ball fields but would be allowed along the bikepath and that the presence of dogs within the park area may cause some controversy.

Barbara Fallon, 12 Little Cove Circle

- Stated that the parking facility on Route 134 in Dennis routinely fills up and overflow parking uses her bike shop parking area. How will the addition of a bikepath bridge over Route 134 impact the existing spaces in the currently DCR lot.
- The design team responded that the project will attempt to minimize any impact to the recently completed parking facility on Route 134.

Kathryn Butler, 77 Barrow Way, Old Townhouse Road

- Suggested that the designers consider implementing "traffic calming" measures at all at-grade crossings with minor streets.
- Suggested pedestrian crossing light may be need across Old Town House Road at Park that connects senior center and park overflow parking area.

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John Powers, 77 Archibald Circle,

- Suggested that the designers consider establishing a park near the Bass River.
- The design team responded that the project would be evaluating the existing abandoned rest area between Route 6 and the railroad right of way adjacent to the Bass River as a potential site for bikepath parking and access to potentially include some park amenities.
- Mr. Powers suggested the project promote connectivity Town-wide to get bicyclists and kids to the bikepath.

Emile Linsky, 29 Simpson Ave.,

- What is the project cost/funding amount?
- The design team responded that the current funding through State Transportation Improvement Program (STIP) is currently 3.5 million

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Tom Wruk	32 Harbour Hill Rd		
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Meeting Notes

Attendees: John Kissida, CDM
George Allaire, Yarmouth
DPW
Joe Magni, VHB

Date/Time: 7:30 AM-3:00 PM April 28, 2006

Project No.: 09794.00

Place: Yarmouth Site Walk

Re: Dennis/Yarmouth: CCRT Feasibility Study

Notes taken by: J. Magni

This site walk was conducted to review various project issues and observe physical and environmental constraints affecting the development of the project feasibility study. The following documents the findings of this site walk:

- Bass River Crossing/Existing Rte 6 motorist Rest Stop
 - Consider moving Route 6 access/egress ramp system to the east and circulate motorists through existing internal roads to access the lot located adjacent to the river for Bike Path parking.
 - Create 10 foot paved path from parking lot to CCRT.
 - Shoulders at existing bridge abutments must be armored to prevent future erosion. CDM to investigate permitting issues associated with required filling and armor.
 - Anticipate retaining granite abutments, but removal of steel beams and replacement with pre-engineered bridge. Aesthetic consideration will need to be considered and also access for fishing although fishing from bridge is not anticipated due to strong current.
- Legend Road to South Dennis Road
 - Consider replacing neighborhood abutter's wooden access stairs on south side of path and/or potential for neighborhood access up slope.
 - Wetlands have been delineated by Brad Hall along the path on the south side. Flags have been placed on the north side; however, wetland is not shown on the plans.
 - Drive Access from Blue Rock Road created drainage wash-out. Advisable to pave the drive and add catch basins at the top of the drive at Blue Rock Road.
 - Gate also should be considered
- North Main Street
 - Vegetation removal necessary for improved sight distance.

- Consider parking areas and picnic areas on available land located on both sides of the road at the end of Whites Path. Town has concern with pavement edge of road and recommends that access control should be addressed with any parking area design
- North Main Street to DuPont Ave.
 - Identify if public lands exist on the south side of the CCRT for a connection to Flax Pond. Several existing pathways exist but well fields must be navigated.
 - Concrete company has encroached significantly onto rail right-of-way (ROW) for product storage and operations. G. Allaire to consider options to deal with this including the sale of the land to the abutter and the potential of construction of visual screen by abutter.
 - Significant evidence of motorcycle and ATV access to the CCRTI. Consider installation of earthen berms, rocks and vegetative barriers to physically prohibit motorized vehicle access to future bike path.
- Beacon Street
 - 8' stockade fence has been erected along the back property line of ten consecutive residential properties located along the length of Beacon Street; beginning at the east end. The eleventh property has a 6 foot stockade fence and the remaining properties are without fencing. Consider extending the 8 foot fencing for the balance of the properties.
 - Erection of 6' or 8' fencing can mitigate some of the remaining properties; however, the elevation of the rail trail at many locations is much higher than the property elevations at the west end of Beacon Street. Designers must consider aligning the BP closer to the private properties in the low areas adjacent to the rail berm (off the rail trail centerline) in combination with fencing to reduce sight lines between BP users and abutters. Locating fence along top of railroad berm was discussed and decided to be an undesirable alternative.
- Beacon Street to Station Avenue
 - The width of the Rail ROW is nearly twice as wide from the west end of Beacon Street to Station Ave. This space has excellent access to Station Ave and Rt 6 is an excellent location for a major parking lot supporting the CCRT function. Regional signing should direct vehicles to this location. New office building appears to have some drainage issues with berming constructed to divert current surface storm water flows from rail area.
- Station Avenue to Fruean Avenue
 - Overhead crossing of Station Ave appears most logical and there is adequate room on either side of the road for grading transitions for the bikeway at 5%. Overhead electrical service will require some relocation in this area to accommodate bikeway overpass.
 - The trash train travels east towards Station Avenue before returning to the west with the trash load. Rail stops located on the tracks opposite Atlantic Avenue restrict trains from advancing to Station Avenue. This is the point at

which the CCRT must divert from the centerline and travel on the south side of the Rail ROW. A chain link fence will be required to separate the pathway and active rail. Minimum distance from edge of rail to fence needs to be confirmed (10' offset from the centerline of track to the edge of the bike path was discussed).

- Fruean Avenue to West Yarmouth Road

- Existing fencing dividing properties from the Rail ROW at the terminus of Fruean Avenue (west side) is located on rail property. This fence will be relocated to the property line at the time the Bike Path is constructed. The wood retaining wall that is adjacent to this fence is located on the property line. It was discussed, that unless the wall is considered to be unstable to support the bike path function, it is assumed that the wall will not be modified.
- Based on field observations, the vertical design (path profile) must be aligned in such a way as to balance the earth work and have minimal impact on the adjacent properties. Low retaining walls or slope revetment systems should be considered to accomplish minimal impact in this area.
- The hydrant located at the terminus of Fruean Avenue may be on Rail property.
- Visual screening of industrial area should be considered in this area.
- Transition of trail into Old Town House Road Park will require some grade transition and should preserve trees where possible along the Railroad tracks as well as new pines planted in park.
- Pathway use by Bikes will require relocation of some of the fenced storage area at back of park.
- Difficulty of incorporating equestrian path into park and bikeway along links golf course discussed.
- Existing Barriers for crossing of Forest road extension and West Yarmouth Road should be retained. The paint on the pedestrian barriers installed at Forest Road is in disrepair. Town needs to sandblast, prime with galvanized primer and paint black with two coats of compatible semi-gloss paint.
- Some tree removal will be required along existing pathway along golf course to maintain 2 foot minimum clearance.
- Small federal jurisdictional wetland located along path adjacent to golf course.
- Pathway at guard rail will need some expansion and guardrail modification

- West Yarmouth Road to Higgins Crowell Road

- Need to consider installation of leaching catch basin along golf course access road to alleviate ponding in area of bikeway along access road.
- New house recently constructed close to path along driving range. Pathway width in area of golf course will need to be expanded from current 8-8 ½ feet to 10 ft.

- The golf course managers have indicated a desire to lengthen the existing driving range. This will necessitate the relocation of the bike path further south in the power line ROW. G. Allaire will request additional survey in the power easement to include this new feature in the Feasibility Study.
- Traffic calming techniques should be considered for the intersections of the bike path with the cart paths. This could include speed humps, speed tables, raised cross walks, textured pavements, realigned intersections, etc. Also, consider use of fencing similar to fence used at West Yarmouth Road crossing to confine golf carts to the cart paths and also create visual elements to identify approaching crossings. It will also be important to discourage bicycle access to golf course pathways. G. Allaire will request additional survey at the bike crossings to facilitate safety improvements in these areas.
- The project should include root barriers and pavement repair strategies for locations affected by root damage.
- Tree and shrub removal will be required along the existing bike path to provide a 2'-3' shoulder.
- A review of Mid-Tech Drive reveals a commercial road that is fully build-out, experiences significant truck traffic, and has no additional space for an off-road bike path. Assuming we are considering a northern route heading for the Service Road in Barnstable, it is therefore advisable to devise a route through the well field site that avoids critical well point zones, and allows for gradual changes in vertical design. A conceptual alignment will be provided by CDM on the existing base plans for use by the Town to survey the route.
- Higgins Crowell Road to Willow Street
 - The northerly alignment approaching Willow Street should be aligned to take advantage of the existing topography for the purpose of minimizing the length of the ramp on the easterly approach to the proposed Willow Street over pass and possibly utilize higher topography on western side of Willow Street.
 - Alternate routes around the electric company and the parking lot at Higgins Crowell Road should also be considered.

○



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Meeting Notes

Attendees: John Kissida, CDM
George Allaire, Yarmouth
DPW
Joe Rodricks, Dennis DPW
Steve Farr, VHB
Joe Magni, VHB

Date/Time: 2:30 AM-4:00 PM May 18, 2006

Project No.: 09794.00

Place: Dennis Site Walk

Re: Dennis/Yarmouth: CCRT Feasibility Study

Notes taken by: J. Magni

This site walk was conducted to review various project issues and observe physical and environmental constraints affecting the development of the project feasibility study in the Section of the Dennis beginning at Route 134 and extending approximately one mile to the Bass River. The following documents the findings of this site walk:

- Route 134
 - A heavy concentration of overhead utilities exists on the east side of the Route 134 corridor at the intersection of the Rail right-of-way. The planning of a structure Disposition of these utilities will play a significant role in the selecting the type of bike crossing selected.
 - A physical connection must be made between the Cape Cod Rail Trail (CCRT) extension and the existing multi-use walkway located on the east side of Route 134.
 - Fencing and other appurtenances existing on the Hall Oil Company property may encroach into the Railroad right-of-way.
 - The historic district line begins approximately 400 west of the Route 134 right-of-way. J. Rodricks will provide mapping to CDM that will show the limits of the Dennis Historical District.
- Main Street
 - Mr. Chilinski, a member of the Dennis Historical District Board resides on the southeast corner of the intersection of the railroad ROW with Main Street.
 - Consider including a pre-engineered structure in the town Hall for the purpose of recreating a train depot near the site of the original depot formerly located on the southwest corner of the intersection of the railroad ROW with Main Street.

- Two existing leaching basins were installed (by the Town) on the west side of the road in the railroad ROW. These leaching basins are connected to nearby catch basins located on Main Street.
- Shoulders at existing bridge abutments must be armored to prevent future erosion.
- Legend Road to South Dennis Road
 - Consider replacing neighborhood abutter's wooden access stairs on south side of path.
 - Wetlands have been delineated by Brad Hall along the path on the south side. Flags have been placed on the north side; however, wetland is not shown on the plans.
 - Drive Access from Blue Rock Road created drainage wash-out. Advisable to pave the drive and add catch basins at the top of the drive at Blue Rock Road.
- North Main Street
 - Vegetation removal necessary for improved sight distance.
 - Consider parking areas and picnic areas on available land located on both sides of the road at the end of Whites Path.
- North Main Street to DuPont Ave.
 - Identify if public lands exist on the south side of the CCRT for a connection to Flax Pond Recreation Area.
 - Concrete company has encroached significantly onto Rail right-of-way (ROW) with product storage and operations. G. Allaire to consider options to deal with this including the sale of the land to the abutter.
 - Significant evidence of motorcycle and ATV access to the CCRT. Consider installation of earthen berms and vegetative barriers to physically prohibit access to future bike path (BP).
- Beacon Street
 - 8' stockade fence has been erected along the back lot of ten consecutive residential properties located along the length of Beacon Street; beginning at the east end. The eleventh property has a 6 foot fence and the remaining properties are without fencing. Consider extending the 8 foot fencing for the balance of the properties.
 - Erection of 6' or 8' fencing can mitigate some of the remaining properties; however, the elevation of the rail trail is much higher than the property elevations at the west end of Beacon Street. Designers must consider aligning the BP closer to the private properties in the low areas adjacent to the rail berm (off the rail trail centerline) in combination with fencing to reduce sight lines between BP users and abutters.
- Beacon Street to Station Avenue
 - The width of the Rail ROW is nearly twice as wide from the west end of Beacon Street to Station Ave. The space is suitable for staging a major parking

lot supporting the CCRT function. Regional signing should direct vehicles to this location.

- Station Avenue to Fruean Avenue
 - The trash train travels east towards Station Avenue before returning to the west with the trash load. Rail stops located on the tracks opposite Atlantic Avenue restrict trains from advancing to Station Avenue. This is the point at which the CCRT must divert from the centerline and travel on the south side of the Rail ROW.
- Fruean Avenue to Forest Road
 - Existing fencing dividing properties from the Rail ROW at the terminus of Fruean Avenue (west side) is located on rail property. The wood retaining wall that is adjacent to this fence is located on the property line.
 - Based on field observations, the vertical design (path profile) must be aligned in such a way as to balance the earth work and have minimal impact on the adjacent properties. Low retaining walls or slope revetment systems should be considered to accomplish minimal impact in this area.
 - The hydrant located at the terminus of Fruean Avenue may be on Rail property.
 - The paint on the pedestrian barriers installed at Forest Road is in disrepair.
- Forest Road to Higgins Crowell Road
 - The golf course managers have indicated a desire to lengthen the existing driving range. This necessitates the relocation of the bike path further south. G. Allaire will request additional survey in the power easement to include this new feature in the Feasibility Study.
 - Traffic calming techniques should be considered for the intersections of the bike path with the cart paths. This could include speed humps, speed tables, raised cross walks, textured pavements, realigned intersections, etc. Also, consider use of fencing to confine golf carts to the cart paths. G. Allaire will request additional survey at the bike crossings to facilitate safety improvements in these areas.
 - The project should include root barriers and pavement repair strategies for locations affected by root damage.
 - Tree and shrub removal will be required along the existing bike path to provide a 2'-3' shoulder.
 - A review of Mid-Tech Drive reveals a commercial road that is fully build-out, experiences significant truck traffic, and has no additional space for an off-road bike path. Assuming we are considering a northern route heading for the Service Road in Barnstable, it is therefore advisable to devise a route through the well fields that avoids critical well point zones, and allows for gradual changes in vertical design. A conceptual alignment will be provided by CDM on the existing base plans for use by the Town to survey the route.
- Higgins Crowell Road to Willow Street

- The northerly alignment approaching Willow Street should be aligned to take advantage of the existing topography for the purpose of minimizing the length of the ramp on the easterly approach to the proposed Willow Street over pass.
- Additional alternate routes must be considered in the event that our connections to Barnstable required a more southern connection to Willow Street. These may include a path around the Electric Company, a path along the abandoned section of Higgins Crowell Road, a path along the Electric easement, and/or a path up the new section of Higgins Crowell Road.
- Consideration should be given for a parking lot at the abandoned portion of Higgins Crowell Road?

○



Vanasse Hangen Brustlin, Inc.

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Memorandum

To: George Allaire
Joseph Rodricks
Rick deMello
Steve Farr
Matt Hayes

Date: October 5, 2006

Project No.: 09794

From: Joseph Magni

Re: Yarmouth/Dennis: CCRT Extension

John Kissida and I met yesterday afternoon to develop a workshop program for the next CAC meeting. I have prepared this email to share with you our thoughts on the format and approach to this next community meeting as follows:

- We assume that this meeting will be a combined Dennis/Yarmouth consensus building meeting. We will rely on you both to pick a venue acceptable to both towns.
- We recommend that Safety officers from Brewster or Harwich be invited to the workshop to discuss their experience with having a regional multi-use path in their town. If this is an acceptable program element, I assume that you can extend the invitation to the Officers in the neighboring towns.
- The DCR project manager in-charge of the CCRT improvements has offered to conduct a site walk of the portion of the CCRT that has been improved last year. To describe the features that are working well and those features and details that are not effective. With your permission, I will contact Danny O'Brien, to request this site walk/meeting. The project manager has also offered to attend our public meeting to provide input as required.
- Kevin Lynch, Chairman of the Falmouth Bikeway committee, has also offered to participate in the CAC meeting to provide input on screening, vandalism, use, etc. With your permission, I will contact Mr. Lynch to request his attendance once the date has been set.
- As for the format of the meeting, John plans to prepare 3 separate 100 scale plan sets to use for the discussion of facility topics. Each of these topics will be described in detail and we will share our thoughts and those received from the public at each of the public informational meetings. It is our objective to resolve all outstanding issues and refine all current alternatives at this meeting. These topics will be presented in a specific set as follows:
 - **Set 1:** Parking, Rest Stops and Restrooms
 - **Set 2:** Horizontal Alignment, Screening locations and Equestrian needs assessment.
 - **Set 3:** Connectivity/Connections, Way Finding, and location of regional signing to and from the bikeway.
- Additionally, we expect to have 8 ½" X 11" graphics detailing concept possibilities at specific areas and maybe some amenity details.

Please consider the following dates for this meeting:

- November 14
- November 15th
- November 16th

John and I look forward to your comments and suggestions regarding the format and dates presented above.

PS: JK: Please update this email should pertinent details be missing.

**CAPE COD RAIL TRAIL EXTENSION
DENNIS/YARMOUTH/BARNSTABLE**

**MEETING AGENDA
DECEMBER 7, 2007**

1. Project Funding/Construction Schedule

2. Project Description and Overview

- a. Limits (including the Barnstable Connection)
- b. Public Meetings/Consensus Building Program
- c. Coordination with DCR (Robin Bergfore) December 21, 2007

3. Design Criteria

- Design Speed = 20 MPH (min)
- Travel Lanes = 5 ft (min)
- Shoulder = 2 ft (min)
- Horizontal Clearance = 3 ft
- Vertical Clearance = 8 ft (min)
- Cross Slope = 1/4 in. / ft.
- Horizontal Radius = 100 ft (@20mph)
- Grades = 5% (max. desirable); 11% (max.)
- High of Eye = 4.5 ft
- High of Object = 0.0 ft
- Sight Distance = 120 ft (up); 160 ft (down)

4. Project Issues

- Major and minor street crossing strategies
- Residential Screening/fencing
- Planting/landscaping
- Parking/Rest Stops
- Permitting and Approvals
- Way Finding
- Connectivity
- Equestrian

5. Project Questions

- 1. Will MHD support the construction of Pedestrian bridges over the high volume arterials (Station Ave., Rte 134, and Willow Street) along the project corridor?
- 2. Will MassHighway be responsible for developing the Operations and Maintenance Agreement for the construction and maintenance of the CCRT over EOT rail property?
- 3. Will Recreation and Cultural Interest Area Symbol Signs (white on brown signs) be allowed on Route 6 (Mid-Cape) to direct CCRT users to parking areas and trail access points?
- 4. Without knowledge of the future volume of users on the CCRT (and therefore, whether pedestrian signal warrants will be satisfied), will MassHighway allow the installation of pedestrian signals at high volume collector roads? If not, will the installation of signal conduit (for future use) be allowed?

5. What is MassHighway's policy on the erection of fencing along residential and commercial properties for prohibiting unwanted accessibility and noise mitigation?
6. Will MassHighway allow the construction of a small structure on Main Street in Dennis (next to the Town Hall) to serve as a tourist information facility?
7. Will MassHighway allow the use of the Route 6 Highway rest stop (now closed) as a CCRT vehicular parking lot and CCRT facility rest stop? This rest stop is located just east of Bass River. If the old rest area is used what access/egress improvements will be required to Route 6.
8. Will MassHighway fund the installation of improved street lighting at the intersection of CCRT at public streets?
9. Will MassHighway support the intersection improvements in the vicinity of the CCRT to improve pedestrian safety and access to the bike path; i.e. White's Path @ Great Western Road?
10. Construction of the rail trail along a small section of the access drive to the Yarmouth Camp Grounds?
11. Does MassHighway have an Engineering Directive that specifies requirements for design and construction of 'Rail with Trails' bike path facilities?
12. Will MassHighway fund construction of parking lots to be located along the CCRT corridor?
13. Will MHD consult with DCR on parking lot adjustments at the existing lot on Route 134 required to construct the pedestrian over Route 134? Who has jurisdiction on this State land?
14. How will MassHighway deal with the commercial and residential encroachment on the RR ROW
15. Funding for Braille signage along the trail along with bicycle amenities (racks and lockers) at strategic locations (major employment centers).
16. Will MHD allow signs on Route 6 directing motorists to the Bike Path?
17. Will MHD be willing to take a permanent easement along Willows St. to maintain the Bike Path along the Railroad

6. Project Schedule



Memorandum

To: Joseph Magni

From: John Kissida

Date: January 23, 2007

*Subject: Final Meeting Minutes for CCRT Extension
December 8 Meeting with YCGA*

A site meeting was held December 8, 2006 at 9 a.m. The weather was very cold with light snow so the walk was somewhat abbreviated. We met with John Hartjen and another member of the Board of Directors of YCGA. Prior to the meeting Yarmouth had the edge of the railroad ROW staked. We walked the section from just north of the playground to the area south of the new entrance road and signal. The following were the key items discussed:

1. The location of the proposed rail trail will require some tree removals and grading since the outer edge of the pathway will be approximately 23 feet from the outer rail and require another 3 feet of no vertical obstructions at a minimum. The limits of the path and vertical clearance were noted in the field as approximately 8 feet inside the staked edge of ROW. It was noted that this limit did not include any grading required. This 8 foot offset line was reviewed at each stake along the edge of ROW starting at just north of the playground to determine approximate impact areas. It was noted that there was a depression that would require fill and possibly a wall. One residence was visible in this area and the representatives from YCGA did not believe the limit of clearing would have any impact on this residence since it is well set back from the limit of clearing and ROW edge.
2. YCGA representatives noted that their main concerns were the area adjacent to the playground/field area, which is sometimes mistaken for a public park and the area along their new access road. The group is concerned with limited public access to this area as well as screening Willow Street, since it's construction has required the removal of most of the tree line along the west side of the RR ROW. In the area of the current playground, it is apparent that most of the existing tree line will be impacted by the new pathway. We noted that based on discussions with MHD it was agreed that a black fabric Chain link fence could be installed in areas where access to private property was a problem and that evergreen or other plantings to screen the path or related to other related items would be considered by MHD on a case by case basis and would likely be

accepted in this location. It was also noted that most of their planted evergreens did not appear that they would be impacted by the new pathway and the ones that were might be able to be relocated. Yarmouth DPW indicated that they would consider moving these trees if MHD would not.

3. It was noted that in the area of the old entrance that is to be abandoned, mounding was proposed under the current project and plantings would be desirable along with a new chain link fence, if the CCRT is constructed in this area.
4. In the area along the new access drive to the YCGA, it was noted that it was likely that all trees within the RR ROW would likely require removal due to the need to raise the grade for pathway construction while also maintaining the drainage ditch. It was noted that some culverts would likely be required. YCGA requested that the chain link fence and additional plantings be considered in areas where tree removal was required.
5. The likely location of the pathway crossing of the new access road was also reviewed, which would be at the stop line and it was noted that the adjacent wetland would require some more detailed survey in this area to determine exactly how pathway would be aligned and graded. The YCGA noted they were planning on adding a new sign identifying the YCGA and access for members and guests only. They also requested the town furnish no parking signs for along the access drive, but it was noted that the no parking could not be enforced without a town vote. YCGA indicated that the signs were more a deterrent.
6. YCGA noted that they observe bike riders going north along the new willow street and under route 6, possibly toward route 6A. They asked that in the design of the overpass of Willow Street and the RR, that the potential to travel north along Willow Street be evaluated. It was noted that one possibility might be to create a ramp on the west side of Willow Street and on grade crossing at the light by the ramp. DPW indicated that the light likely did not have a pedestrian crossing phase and this would need to be looked into with other alternatives to provide potential access to the north.

The meeting ended around 10 a.m.

**Citizens Advisory Committee Meeting
CCRT Meeting Agenda
January 25, 2007**

Introductions of Attendees

Discussion of Meetings and Findings since Last CAC Meeting in November:

- Site Meeting with Yarmouth Campground Representatives
- Meeting with MHD on Anticipated Project Approach and Findings
- Meeting with DCR on Existing CCRT Design and Construction "Lessons Learned"

Questions and Discussion

Anticipated Project Schedule Moving Forward including Additional Meetings:

- Yarmouth Selectman's Meeting Presentation
- Dennis Selectman's Meeting Presentation
- Public Meeting on Feasibility Study Findings
- Final Report Preparation and Submittal to MHD

Adjournment

From: Kissida, John [KissidaJE@cdm.com]
Sent: Thursday, February 08, 2007 7:10 AM
To: Magni, Joseph
Subject: FW: Yarmouth/Dennis Bike Path Extension
FYI AND FILE.

From: clayrotgov@comcast.net [mailto:clayrotgov@comcast.net]
Sent: Wednesday, February 07, 2007 6:37 PM
To: jsaben@yarmouth.ma.us
Cc: clayrotgov@comcast.net; gallaire@yarmouth.ma.us; Kissida, John
Subject: Yarmouth/Dennis Bike Path Extension

Dear Chairman Saben:

The Agenda for the February 13 Selectman's Meeting includes a presentation re the Dennis/Yarmouth Bike Path Extension. The discussion will relate to the Feasibility Study that is in the completion stage.

The Bike Path will in many respects follow the non-used railroad Right of Way. The Right of Way travels along the full length of Beacon Street. Two Beacon Street households are represented on the Dennis/ Yarmouth Citizens Advisory Committee-- Harry Walker (126 Beacon Street) and Barry Clayman (90 Beacon Street).

The Beacon Street representatives are very positive regarding the Bike Path and the feasibility study in general. The Bakers Path Association has been kept apprised of the Feasibility Study and there have not been negative comments re the Bike Path and the Study.

The Citizens Advisory Committee Meetings have entertained comments re potential impact on the areas within both Dennis and Yarmouth. The residential property owners are of course concerned about sight and noise pollution and privacy issues. Comments at the Bakers Path Association Meeting related to fencing that would provide privacy.

The Feasibility Study from its inception acknowledged the impact on the Beacon Street residential properties. The Study calls for the movement of the bike path from the railroad rail-bed (Tracks) to the northern side of the 80' Right of Way. If that can be accomplished and the rail bed does not have to be altered to address "Grading" issues, the Bike Path can be lower than the rail-bed and therefore, there may not be a need for Fencing.

The next phase of the Plan is the Design Phase. The Citizens Advisory Committee will be having a Site Walk along the Beacon Street Railbed . That walk will assist in determining if the path can be moved and to what degree the rail-bed might be lowered. It would also determine if fencing is required to provide privacy.

If fencing is required, there is concern that the "Chain Link" fencing that is approved by the Mass. Highway Dept. may not be what is required to provide privacy to the residential properties. **We would ask that the Selectmen be prepared to request the Mass. Highway Dept. to accommodate the Residential properties and provide appropriate privacy fencing, such as stockade fencing.**

I regret that I will not be able to attend the February 13 meeting. Please provide this message to the other Selectmen.

I would also like to bring to your attention the support and assistance provided to the Citizens Advisory Committee by George Allaire, DPW and John Kissida, Camp Dresser and McKee Inc.

Please advise of receipt of this message.

Barry Clayman
90 Beacon Street



**Meeting
Notes**

Attendees: Robert Gregory: MHD Dist 5 Traffic
Mark Carmichael: MHD Dist 5 Projects
Robert Wheeler: District 5 Projects
Joseph Rodricks: Town of Dennis
George Allaire: Town of Yarmouth
John Kissida: CDM
Joseph Magni: VHB

Date/Time: 8:30 AM

Project No.: 09794.00

Place: MHD District 5 Office-Taunton

Re: CCRT Extension

Notes taken by: J. Magni

This meeting was held to acquaint MHD with bike path routing options, design details and criteria, original project budget, anticipated project schedule, and familiarization with the public outreach program in the Town's of Barnstable, Dennis and Yarmouth. The following specific issues were discussed: (see meeting agenda; attached).

1. Project Funding/Construction Schedule: G. Allaire offered that this project (SID 604488) has a total federal earmark amount of \$2,598,780. Total funding breakdown is as follows:
 - a. CMAQ Target Authority Part A Yr 2010 :
 - i. Federal=\$1,100,434.00
 - ii. State = \$275,108.00
 - iii. Total: \$1,375,542
 - b. Other Federal Aid Projects-SAFETEA-LU Earmark TI # 173
 - i. Federal = \$ 2,122,000.00
 - ii. State = \$ 530,500.00
 - iii. Total = \$2,652,500
 - c. Project Total Funding = \$ 4,028,042.00
 - d. The budget was based on a July 2004 budget that itemized, at a conceptual level, \$3.46 million for total construction. M. Carmichael suggested that project costs have increased substantially and that additional funds will be required.

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2. G. Allaire also stated that he has been working with Town of Barnstable representatives to establish the destinations in Barnstable that are desired and; therefore must be taken into consideration in making conceptual decision relative to crossing Willow Street. Thus far, the Town of Barnstable has confirmed that there are two destinations as follows:
 - a. The Inter-modal Center located on Main Street in Hyannis: this will require the Yarmouth/Dennis Extension Project include a link to the airport parking lot. This link will likely parallel the west side of the existing RR tracks and within the RR ROW. This will necessitate a rails-with-trails cross section along this connection.
 - b. The Clair Saltenstal Bike path at Rte 132; this will require a connection that parallels the south side of the Route 6 ROW. The route will be positioned in town of Yarmouth owned property and Commonwealth of Massachusetts Fish and Wildlife property.
3. J. Magni briefly described the general scope of improvements and limits of work in both Yarmouth and Dennis. He further outlined the details of the public outreach program to date; issuing a schedule of previous held events and upcoming events. M. Carmichael requested that MassHighway be invited to all future public meetings.
4. J. Magni also explained that coordination has begun with the Massachusetts Department of Conservation and Recreation. We plan to conduct a site walk with Robin Bergfore, Field Project Manager of the CCRT improvement Project, on December 21st beginning in Conference Room A at 9:00 AM. The MHD representatives are invited to participate in this meeting.
5. The following Project Design criteria intended for use on this project was, in general, accepted for further development on this project.
 - a. • Design Speed = 20 MPH (min)
 - b. • Travel Lanes = 5 ft (min)
 - c. • Shoulder = 2 ft (min)
 - d. • Horizontal Clearance = 3 ft
 - e. • Vertical Clearance = 8 ft (min)
 - f. • Cross Slope = ¼ in. / ft.
 - g. • Horizontal Radius = 100 ft (@20mph)
 - h. • Grades = 5% (max. desirable); 11% (max.)
 - i. • High of Eye = 4.5 ft
 - j. • High of Object = 0.0 ft
 - k. • Sight Distance = 120 ft (up); 160 ft (down)
6. J. Kissida presented a detailed explanation of the status of the Project design development to date. This included general comments on the following project issues at the locations that each apply:
 - a. Major and minor street crossing strategies
 - b. Residential Screening/fencing
 - c. Planting/landscaping
 - d. Parking/Rest Stops
 - e. Permitting and Approvals
 - f. Way Finding
 - g. Connectivity

7. Policy and engineering questions, that were forwarded to M. Carmichael in advance of the meeting, were discussed in detail as follows:
- a. Will MHD support the construction of Pedestrian bridges over the high volume arterials (Station Ave., Rte 134, and Willow Street) along the project corridor?

i. Response: Overpasses will be considered as long as the location under consideration for grade separations meet Warrants provided in the 2006 edition of the MassHighway Design Guidelines
 - b. Will MassHighway be responsible for developing the Operations and Maintenance Agreement for the construction and maintenance of the CCRT over EOT rail property?

i. Response: The Town proponents will be required to obtain a long term lease Agreement with EOT for this purpose.
 - c. Will Recreation and Cultural Interest Area Symbol Signs (white on brown signs) be allowed on Route 6 (Mid-Cape) to direct CCRT users to parking areas and trail access points?

i. Response: Current MassHighway policy discourages the use of Cultural Interest Area Symbol signs on State Highway to minimize sign pollution. They recommend the use of printed informational flyers be distributed to bike shops, Chamber of Commerce outlets, etc to advertise the existence and location of the bike path. Signs existing today for this purpose are grandfathered.
 - d. Without knowledge of the future volume of users on the CCRT (and therefore, whether pedestrian signal warrants will be satisfied), will MassHighway allow the installation of pedestrian signals at high volume collector roads? If not, will the installation of signal conduit (for future use) be allowed?

i. Response: MassHighway will require that project proponents use the guidance provided in the 2006 edition of the MassHighway Design Guidelines in combination with MUTCD and estimated pedestrian counts to warrant signalization at appropriate locations. At a minimum, traffic signal conduit and handholds should be provided at each crossing.
 - e. What is MassHighway's policy on the erection of fencing along residential and commercial properties for prohibiting unwanted accessibility and noise mitigation?

i. Response: MassHighway will review the need for this type of access and noise mitigation in residential areas on a "case by case" basis. Use in the historical districts will be allowed. Vinyl clad chain link fence is the current standard for this type of mitigation. The use of plantings for visual screening would also be considered.
 - f. Will MassHighway allow the construction of a small structure on Main Street in Dennis (next to the Town Hall) to serve as a tourist information facility?

i. Response: MassHighway will approve erection of informational Kiosk; however, vertical structure will not be approved as part of the programmed funding. A vertical structure maybe included in the project as a non-participating item. MassHighway will clarify their position on the non-participating aspect of this issue at later stages of project development since it could create issue with bidding.

- g.** Will MassHighway allow the use of the Route 6 Highway rest stop (now closed) as a CCRT vehicular parking lot and CCRT facility rest stop? This rest stop is located just east of Bass River. If the old rest area is used what access/egress improvements will be required to Route 6.

i. Response: MassHighway has had numerous requests in the past regarding adaptive reuse of this site. They understand the logic in the request; however, their policy is not to support a new exit/destination on this highway. They do recommend; however that the recommendations in the Feasibility Study retain this feature as a future option.

- h.** Will MassHighway fund the installation of improved street lighting at the intersection of CCRT at public streets?

i. Response: MassHighway understand that highway lighting at the intersection of public street is a reasonable safety feature; however, the project proponent must coordinate this service separately directly with the street light provider.

- i.** Will MassHighway support the intersection improvements in the vicinity of the CCRT to improve pedestrian safety and access to the bike path; i.e. White's Path @ Great Western Road?

i. Response: MassHighway will entertain highway pedestrian safety improvements as part of the CCRT Extension project. Consideration of approval of each location will occur at the Preliminary Design Phase.

- j.** Will MassHighway be willing to take a permanent easement along Willows St. to maintain the Bike Path along the Railroad along a small section of the access drive to the Yarmouth Camp Grounds?

i. Response: MassHighway will delay approved actions for this section of the bike path until the project proponent flushes out all the design details and has a full understating of impacts and property owner requirements

- k.** Does MassHighway have an Engineering Directive that specifies requirements for design and construction of 'Rail with Trails' bike path facilities?

i. Response: MassHighway provides guidance for the design of Rail-with-trails in Chapter 11 Shared Use Paths and Greenways in the 2006 edition of the MassHighway Design Guidelines

- l.** Will MassHighway fund construction of parking lots to be located along the CCRT corridor?

i. Response: MassHighway insists that parking lots be included as part of the bike path project; however, they encourage designers to use granular surfacing rather than hot mix asphalt. MHD would also consider partial pavement of aisles and handicapped spaces.

- m.** Will MHD consult with DCR on parking lot adjustments at the existing lot on Route 134 required to construct the pedestrian over Route 134? Who has jurisdiction on this State land?

i. Response: MassHighway will participate in a collaborative process to achieve consensus for design and construction issues with DCR. DCR maintains jurisdiction on the existing CCRT corridor.

- n.** How will MassHighway deal with the commercial and residential encroachment on the RR ROW?

i. Response: MassHighway recommends that the proponent immediately forward a letter notifying the abutters of the encroachment, the impending construction

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schedule, and the requirement that the abutter remove the encroachment by a date certain. This letter shall carbon copied to MassHighway for their records. If, at the latter stages of design, the encroachment has not been removed, the MassHighway will be responsible for resolving the matter.

- o.** Funding for Braille signage along the trail along with bicycle amenities (racks and lockers) at strategic locations (major employment centers).

 - i.** *Response: MassHighway indicated that Braille programs are not new for pedestrian facilities. They will reserve comment on this concept until the details are further developed in the preliminary design stages of project development.*



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Memorandum

To: Yarmouth Board of Selectmen

Date: February 12, 2007

Project No.: 09704.00

From: Joseph D. Magni, Jr P.E.

Re: Yarmouth: Cape Cod Rail Trail

The Project detail outlined below will be used to update the selectmen on the current status of the bike path extension project:

1) Project Funding:

- CMAQ: \$1,100,434 (FHWA) + \$275,108 (State)= \$1,375,542
- Safetee-LU: \$2,122,000 (FHWA) + \$530,500 (State)= \$ 2,652, 500
- Total=\$4,028,042.00

2) Consensus Building Program/ Project Schedule:

- Stakeholders Project Kick-off **June, 2006**
- General Dennis & Yarmouth Information Meeting **September, 2006**
- Conceptual Workshop **November, 2006**
- Kick-Off meeting with MassHighway and DCR **December, 2006**
- CAC Sub-Committee Meeting **January, 2007**
- Selectmen's Meeting **February, 2007**
- Preferred Plan Public Meeting **March, 2007**
- Completion of Feasibility Study

3) General Project Limits and Path Details

- Limits
- Cross Section Dimensions (Typical Section Board)
- Safety Barriers/Equestrian Trail
- Existing Bike paths Sections
- Diversion from the Rail ROW

4) Project Details

- Bridges
 - Bass River
 - Rte 134/Station Avenue/Willow Street Rail road Bridge
- At-Grade Intersections
 - North Main Street
 - Forest Road
 - West Yarmouth
 - Higgins Crowell Road

5) Special Consideration

- Parking Areas
- Rest Stops: Furniture/Racks/Kiosks
- Bike Path Identity (Mile marker/Barricades-Bollards)

6) Abutters Considerations

- Yarmouth Camp Ground Association
 - Fencing and Vegetation to avoid access and visibility
 - Original Entrance: Plantings and Chain Link Fencing
 - New Entrance: Plantings and Chain Link Fencing
 - Parking Signs
 - North Bound travel on Willow Street
- Beacon Street Residents
 - Shift BP to North Side
 - Use of Topography to conceal users
 - Fencing to obscure visibility



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Meeting Notes

Attendees: James Saben, Chair BOS
Aubrey Groskopt, BOS
William Marasco, BOS
Susanne McAuliffe, BOS
Jerome Sullivan, BOS
Robert Lawton, Jr., Town
Administrator
George Allaire, YDPW
Joseph Magni, VHB

Date/Time: February 13, 2007 @ 7:00 PM

Project No.: 09794.00

Place: Selectmen's Meeting
Chambers

Re: Yarmouth: CCRT Extension Project Update
- Selectmen's Workshop

Notes taken by: J. Magni

This meeting was held as a programmatic component of the Cape Cod Rail Trail Extension Project (CCRT) Public Consensus Building Program. The purpose of this meeting was to provide the Town of Yarmouth Board of Selectmen with an update on the details of the development of the CCRT Feasibility Study and to solicit general input from this Executive Board relative to project scope, schedule, Citizen Advisory Committee activities, project alternatives, etc. The following issues were discussed:

1) Project Overview: G. Allaire presented the following

- A general definition of the need and purpose for the Regional Cape Cod Rail Trail Extension project.
- A detailed description of the Project limits.
- Identification of the projects major features.
- An understanding of the Town's collaborative efforts with the adjacent Town's of Barnstable and Dennis.

Additionally, Mr. Allaire presented the various alignment options under consideration by the Town of Barnstable relative to regional connectivity to the Clair Saltenstall Bike Route and the Hyannis Multi-Modal Center. He explained that the Commonwealth of Massachusetts Division of Fish and Wildlife own and maintain the properties that lie in our path to the Clair Saltenstall bike route located on Route 132. This state organization has issues a written statement that they will not allow active recreation on this property. In general, this is a standing policy that is intended to preserve the habitat for existing native

wildlife communities. Therefore, the Town of Barnstable is considering other alignment alternatives to establish the desired connectivity to the regional bike route system.

2) **Selectmen's Package:** J. Magni provided a brief overview of the following:

- A general description of the purpose of the three types of plans issued to the Selectmen in preparation of this workshop.
- An outline of the planning process followed by the Town and their Consultant Team to identify and measure various project constraints in an effort to develop a comprehensive Existing Conditions Analysis plan set.
- An outline of the development process used by the Town and their Consultant Team to select various alignment alternatives shown on the Schematic Alignment and Design Consideration Plans.

3) **Project Funding:** J. Magni provided a detailed outline of the sources of project funding as follows:

- CMAQ: \$1,100,434 (FHWA) + \$275,108 (State)= \$1,375,542
- SAFETEA-LU: \$2,122,000 (FHWA) + \$530,500 (State)= \$ 2,652, 500

Project Total=\$4,028,042.00

4) **Consensus Building Program/ Project Schedule:** J. Magni provided a detailed outline of the sources of project consensus building program as follows:

- Stakeholders Project Kick-off **June, 2006**
- General Dennis & Yarmouth Information Meeting **September, 2006**
- Conceptual Workshop **November, 2006**
- Kick-Off meeting with MassHighway and DCR **December, 2006**
- CAC Sub-Committee Meeting **January, 2007**
- **Selectmen's Meeting February, 2007**
- Preferred Plan Public Meeting **March, 2007**
- Completion of Feasibility Study

5) **General Project Limits and Path Details:** J. Magni offered additional project details associated with the following:

- Cross Section Dimensions (Typical Sections)
- Safety Barriers/Equestrian Trail
- Existing Bike paths Sections (Old Town House Road Park and the Golf course)
- Diversion from the Rail ROW

6) **Project Details** J. Magni offered additional project details associated with the following:

- Bridge Crossings
 - CAC was not in favor of tunnel structures.
 - Bass River bridge and slope restoration
 - Rail Road Bridge (truss) @ Rte 134, Station Avenue, and Willow Street
- At-Grade Intersections (Possible pedestrian signals if warrants are met)
 - North Main Street
 - Forest Road
 - West Yarmouth

7) **Special Consideration** J. Magni offered additional project details associated with the following:

- Parking Area locations and use
- Rest Stops: Furniture/bike racks/Information kiosks
- Bike Path Identity (Mile marker/Barricades-Bollards)

8) **Abutters Considerations** J. Magni offered details associated with specific abutter concerns as follows:

- Yarmouth Camp Ground Association
 - Fencing and Vegetation to avoid access and visibility
 - Original Entrance: Plantings and Chain Link Fencing
 - New Entrance: Plantings and Chain Link Fencing
 - Parking Signs
 - Accommodations for access to northbound travel on Willow Street
- Beacon Street Residents
 - Shift BP to North Side
 - Use of Topography to conceal users
 - Fencing to obscure visibility

9) **Discussion:** A question/answer period followed the formal presentation. The following subjects were discussed:

- Question #1: Will construction funds expire? G. Allaire stated that the funds mentioned above are dedicated to this project through the State's and FHWA's SAFETEA-LU and Congestion Mitigation (CMAQ) Transportation funding mechanisms and will not be withdrawn.
- Question #2: How will the project resolve bridge architecture? J. Magni said that MassHighway requires consideration for bridge architecture in all bridge projects. MassHighway in conjunction with the Town will select an appropriate architectural theme to create an identity for this project. Based on input by the CAC, it is likely that a Railroad theme will be implemented for the project bridges.
- Question #3: When will construction commence? G. Allaire stated that the project construction phase will likely commence in fiscal year 2010.
- Question #4: How long will the project be in under construction? G. Allaire stated that require two full seasons will be required to complete all bike path improvements.
- Question #5: What is meant by "Bridge Warrant's and how will bridge fit into Yarmouth's vision for aesthetics?" G. Allaire offered that during our meeting with MassHighway, the District 5 Project Development Engineer stated that bridges will only be considered if each proposed structure meets the warrants outlined in the 2006 edition of the Massachusetts Highway Department Project Development and Design Guide. A review of Chapter 10 – Bridges reveals the following list of factors affect the decision to provide a pedestrian or bicycle bridge
 - a. When a need exists to carry pedestrians and bicycle traffic over and obstacle, usually vehicle traffic, a railroad, or a watercourse.
 - b. When the inclusion of a bridge structure reduces travel time for the pedestrian.
 - c. When schools, churches, parks, open space, and other land uses exist that generate large volumes of pedestrian or cyclists.
 - d. When an unacceptable traffic conflicts due to roadway width, high traffic speeds, and high traffic volumes.
 - e. Cost/benefit ratio is also an critical factor in this assessment

With respect to aesthetics, subsection 10.3.2 of the Massachusetts Highway Department Project Development and Design Guide state that the goal of each project is to achieve aesthetically-pleasing bridges. The following list of success factors affects the ability to achieve this goal:

- a. When the primary structural systems represent the basic structural mechanics of how the structure carries the applied loads to the foundations and therefore successfully expresses the natural, physical properties to which people intuitively relate.
 - b. How the overall bridge relates to its setting
 - c. The human-level experience of a pedestrian, or cyclist, or boater traveling over, under or beside the bridge
 - d. The driver-level experience of someone driving over or under the bridge.
- Question #6: Define the problem associated with the connection to the Clair Saltenstall bike route? As detailed above, the Commonwealth of Massachusetts Division of Fish

and Wildlife (MDFW) control the properties that lie in the desired path connecting the CCRT Extension to the Clair Saltenstall bike route located on Route 132. It is assumed that Commonwealth of Massachusetts Laws and Regulations allows the MDFW the authority to prohibit any public use other than that which is described as 'passive recreation'. Given that the CCRT Extension multi-use path is considered active recreation, the MDFW is permitted to deny our projects request for access through their property.

- Question #7: What is the fall back position if Barnstable cannot define a corridor for the Bike path in their town? G. Allaire stated that the westerly extension of the CCRT will terminate at the proposed rest stop and parking lot proposed for the abandoned portion of Higgins Crowell Road.
- Question #8: Can erecting signs be erected on Willow Street directing motorists to Higgins Crowell Road parking lot? G. Allaire stated that the project proposes an extensive regional and local 'way-finding' program of signing to direct motorists to the proposed parking areas along the CCRT Extension
- Question #9: Does the Town own the area off Whites Path (near North Main Street) on which a parking lot is proposed? G. Allaire answered in the affirmative and offered that the Town owns the parcel of land located between White's Path roadway and the Mid-Cape Highway (Route 6) fence.
- Question #10: What are the hydraulic considerations at the Bass River Bridge? G. Allaire stated that he has commissioned a flushing study of the Bass River to determine the appropriate width the bridge opening must be to optimize the river's flushing capabilities. He further offered that he assumes that the bridge opening width will be approximately equal to the overall span length of the mid-cape bridge located several hundred feet to the north.

This meeting ended with the identification of the following series of action items:

1. Conduct a final Public informational meeting
2. Complete the production of a draft and final CCRT Extension Feasibility Study
3. Prepare a comprehensive scope of design services for the completion of Preliminary Design Documents (25% Plans) in conformance to MassHighway Design guidelines.



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Meeting Notes

Attendees: Jane Otis,
Paul McCormick,
Sheryl McMahon,
Charles Crowell
Heidi Schadt.
Robert Canevazzi, Town
Administrator,
Sandra Fife, Assistant Town
Administrator
Wendy Pells, Secretary
Joseph Rodricks, Dennis
DPW
George Allaire< Yarmouth
DPW
Joseph Magni, VHB

Date/Time: July 17, 2007 (7:45 PM)

Project No.: 09794.01

Place: Dennis Town Offices

Re: Dennis/Yarmouth: Board of Selectmen
Project Update Meeting

Notes taken by: Joseph Magni

This meeting was held as a programmatic component of the Cape Cod Rail Trail Extension Project (CCRT) Public Consensus Building Program. The purpose of this meeting was to provide the Town of Dennis of Selectmen with an update on the details of the development of the CCRT Feasibility Study and to solicit general input from this Executive Board relative to project scope, schedule, Citizen Advisory Committee activities, project alternatives, etc. The following issues were discussed:

1) **Project Overview:** J. Rodricks presented the following project introduction.

- A general definition of the need and purpose for the Regional Cape Cod Rail Trail Extension project.
- A detailed description of the Project limits.
- Identification of the projects major features.
- An understanding of the Town's collaborative efforts with the adjacent Town's of Barnstable and Yarmouth.

2) **Selectmen's Package:** J. Magni provided a brief overview of the following:

- A general description of the purpose of the three types of plans issued to the Selectmen in preparation of this workshop.

- An outline of the planning process followed by the Town and their Consultant Team to identify and measure various project constraints in an effort to develop a comprehensive Existing Conditions Analysis plan set.
 - An outline of the development process used by the Town and their Consultant Team to select various alignment alternatives shown on the Schematic Alignment and Design Consideration Plans.
- 3) **Consensus Building Program/ Project Schedule:** J. Magni provided a detailed outline of the sources of project consensus building program as follows:
- Stakeholders Project Kick-off **June, 2006**
 - General Dennis & Yarmouth Information Meeting **September, 2006**
 - Conceptual Workshop **November, 2006**
 - Kick-Off meeting with MassHighway and DCR **December, 2006**
 - CAC Sub-Committee Meeting **January, 2007**
 - Yarmouth Selectmen's Meeting **February 13, 2007**
 - Dennis Selectmen's Meeting **July 24, 2007**
 - Completion of Feasibility Study
- 4) **General Project Limits and Path Details:** J. Magni offered additional project details associated with the following:
- Cross Section Dimensions (Typical Sections) included a 10 foot paved path with 3 foot shoulders
 - Safety Fencing will be proposed at locations where side slope exceed safety standards
 - A 5-foot wide equestrian path is under consideration for portions of the Trail.
 - The entire horizontal alignment is designed to exist entirely within the existing Rail ROW
- 5) **Project Details** J. Magni offered additional project details associated with the following:
- Bridge Crossings: During the CAC workshops, members were not encouraged to support the use of tunnels to cross major roads such as Route 134. They sited concerns about security and maintenance costs. Their preference was to style proposed bridges after conventional truss type railroad bridge. A sample photograph depicting this type of bridge superimposed over Route 134 was presented to the Selectmen.
 - Also, a sample photograph depicting a deck type bridge superimposed over Bass River was presented to the Selectmen.
 - Pedestrian signals will be proposed at the Main Street at-grade Intersections if signal warrants are met.
- 6) **Special Consideration** J. Magni offered additional project details associated with the following:
- A parking lot is proposed at the west side of Route 134 and adjacent to the Town Hall Parking lot. Consideration for additional parking at the Mid-Cape highway rest stop (located next to Bass River) is under review; however, MassHighway is not encouraged to allow this use.

- A rest stop is proposed at the public lands located adjacent to Town Hall. This rest stop will include benches, bike racks, picnic tables and an informational kiosk
- The Bike path will also include granite mile marker posts, 1/10th mile markers in the pavement, and barricades/bollards at the intersections to discourage vehicular access to the trail.

7) **Discussion:** The following issues were discussed after completion of the formal presentation:

- The Selectmen recommended that coordination with representatives of the Historic Commission and the neighborhood surrounding the Main Street be conducted early and often during project design development.
- The Selectmen questioned who would be responsible for the long term maintenance of the CCRT through the Town of Dennis. Joe Rodricks and George Allaire offered that, although this responsibility will fall on the Town's of Dennis and Yarmouth, it appears appropriate to request the state to transfer this responsibility to the Department of Conservation and Recreation.
- The Selectmen asked for an outline of the overall project schedule. J. Rodricks indicated that the earmarked funds are available at this time to commence design immediately; however, additional construction funds will be required which will likely push the commencement of construction out 3 or 4 years.
- With respect to the Bass River Bridge, Selectmen were concerned that public funds would be wasted to construct the proposed deck as part of this project while at some later time, the Army Corps, who is conducting a study of the Bass River flood characteristic, may propose a change in the size and location of the bridge to improve upstream hydraulic conditions. It was explained that it is unlikely that the Army Corps would advance their proposed improvements to the Bass River Bridge for many years after the municipal construction is complete.
- When asked about the current ownership of the railroad Right of Way, G. Allaire offered that although the Memorandum of Agreement is not yet finalized, it is expected that the Executive Office of Transportation will complete the process well in advance of the project construction phase.

Magni, Joseph

From: Kissida, John [KissidaJE@cdm.com]
Sent: Wednesday, May 23, 2007 5:41 PM
To: Magni, Joseph
Subject: FW: Final Meeting minutes for CCRT Extension: 12/8 Meeting with YCGA

From: Kissida, John
Sent: Friday, December 15, 2006 9:52 AM
To: 'Magni, Joseph'
Subject: Final Meeting minutes for CCRT Extension: 12/8 Meeting with YCGA

A site meeting was held last Friday morning 11/28 at 9 am. The weather was very cold with light snow so the walk was somewhat abbreviated. We met with John Hartjen and another member of the Board of Directors of YCGA. Prior to the meeting Yarmouth had the edge of the railroad ROW staked. We walked the section from just north of the playground to the area south of the new entrance road and signal. The following were the key items discussed:

1. The location of the proposed rail trail will require some tree removals and grading since the outer edge of the pathway will be approximately 23 feet from the outer rail and require another 3 feet of no vertical obstructions at a minimum. The limits of the path and vertical clearance were noted in the field as approximately 8 feet inside the the staked edge of ROW. It was noted that this limit did not include any grading required. This 8 foot offset line was reviewed at each stake along the edge of ROW starting at just north of the playground to determine approximate impact areas. It was noted that there was a depression that would require fill and possibly a wall. One residence was visible in this area and the representatives from YCGA did not believe the limit of clearing would have any impact on this residence since it is well set back from the limit of clearing and ROW edge.
2. YCGA representatives noted that their main concerns were the area adjacent to the playground/field area, which is sometimes mistaken for a public park and the area along their new access road. The group is concerned with limited public access to this area as well as screening Willow Street, since it's construction has required the removal of most of the tree line along the west side of the RR ROW. In the area of the current playground, it is apparent that most of the existing tree line will be impacted by the new pathway. We noted that based on discussions with MHD it was agreed that a black fabric Chain link fence could be installed in areas where access to private property was a problem and that evergreen or other plantings to screen the path or related to other related items would be considered by MHD on a case by case basis and would likely be accepted in this location. It was also noted that most of their planted evergreens did not appear that they would be impacted by the new pathway and the ones that were might be able to be relocated. Yarmouth DPW indicated that they would consider moving these trees if MHD would not.
3. It was noted that in the area of the old entrance that is to be abandoned, mounding was proposed under the current project and plantings would be desirable along with a new chain link fence, if the CCRT is constructed in this area.
4. In the area along the new access drive to the YCGA, it was noted that it was likely that all trees within the RR ROW would likely require removal due to the need to raise the grade for pathway construction while also maintaining the drainage ditch. It was noted that some culverts would likely be required. YCGA requested that the chain link fence and additional plantings be considered in areas where tree removal was required.
5. The likely location of the pathway crossing of the new access road was also reviewed, which would be at the stop line and it was noted that the adjacent wetland would require some more detailed survey in this area to determine exactly how pathway would be aligned and graded. The YCGA noted they were planning on adding a new sign identifying the YCGA and access for members and guests only. They also requested the town furnish no parking signs for along the access drive, but it was noted that the no parking could not be enforced without a town vote. YCGA indicated that the signs were more a deterrent.
6. YCGA noted that they observe bike riders going north along the new willow street and under route 6, possibly

5/24/2007

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